Historic, archived document

Do not assume content reflects current scientific knowledge, policies, or practices.

aQK51
.C37

United States
Department of
Agriculture

**Soil
Conservation
Service**

Cape May
Court House, NJ

1991
ANNUAL REPORT

Cape May
Plant Materials
Center



Eastern Gamagrass

SEP 22 '92
USDA LIBRARY

TABLE OF CONTENTS

Page

INTRODUCTION
- History & Objectives..... 1
- PMC Location & Site Description..... 2
- Major Land Resource Area Delineations..... 3

SERVICE AREA
- Description of Service Area..... 8
- Location of Current Off-Center Planting Sites..... 10

CLIMATOLOGICAL DATA for 1991..... 11

PROJECT ACTIVITIES
- Water Quality Projects..... 12
- Sand Dune Restoration Projects..... 24
- Cover Crop Projects..... 33
- Tidal Zone Stabilization Projects..... 38
- Wind Diversion Projects..... 40
- Contractile Agreements with the National Park Service..... 44
- Miscellaneous PMC Projects..... 49
- Cape May PMC Crop Fields..... 51

COMMERCIALLY RELEASED CULTIVARS
- *Lonicera maackii* 'Rem-Red' amur honeysuckle..... 53
- *Ammophila breviligulata* 'Cape' American beachgrass..... 53
- *Lespedeza thunbergii* 'VA-70' shrub lespedeza..... 53
- *Spartina patens* 'Avalon' saltmeadow cordgrass..... 54
- *Panicum amarum* var. *amarulum* 'Atlantic' coastal panicgrass..... 54
- *Carex kobomugi* 'Sea Isle' Japanese sedge..... 54
- *Juniperus conferta* 'Emerald Sea' shore juniper..... 55

TRAINING, PRESENTATIONS, PUBLICATIONS and WORKSHOPS..... 56

NEW BUILDINGS and EQUIPMENT..... 58

Trade names used herein are for convenience only. No endorsement of products is intended, nor is criticism of unnamed products implied.

PERSONNEL

Manager	Donald W. Hamer
Soil Conservationist	Michael R. Fournier
Agronomist Trainee	Randy H. Mandel (transferred 3/24/91)
Agronomist	Dr. Sandra J. Primard
Foreman	Wilson J. Merrick (retired 2/2/91)
Biological Technician	Noel J. Murray
Secretary	Barbara A. Turnier
Biological Aid	Peter McFadden (resigned 8/21/91)
Biological Aid	James T. Futrell (from 4/23/91)
Biological Aid	Scott R. Waddell (from 5/19/91)

PLANT MATERIALS SPECIALISTS

W. Curtis Sharp	National Plant Materials Specialist
David G. Lorenz	NENTC Plant Materials Specialist
Christopher F. Miller	NJ Plant Materials Specialist
Stephen K. Salvo	NC Plant Materials Specialist

CAPE MAY PMC STATE CONSERVATIONISTS' ADVISORY COMMITTEE

Cecil B. Currin, Chairperson	NJ State Conservationist (from 11/3/91
Barbara T. Osgood, Chairperson	NJ State Conservationist (until 5/23/9
Richard A. Gallo	MA State Conservationist
Bobbye Jack Jones	NC State Conservationist
George Norris	VA State Conservationst

All SCS programs and services are offered on a nondiscriminatory basis, without regard to race, color, national origin, religion, sex, age, marital status, or handicap.

INTRODUCTION

History & Origin

The activities of the Cape May Plant Materials Center (CM PMC), for the calendar year of 1991 are contained in this report. The PMC is solely operated by the United States Department of Agriculture's Soil Conservation Service (USDA-SCS) in the state of New Jersey. The 88 acre Cape May PMC was established in 1965 after extensive storm damage had eroded much of the Mid-Atlantic coastline. The service area of this PMC is served by two Plant Materials Specialists stationed in North Carolina and New Jersey.

The Cape May PMC has been given the task of developing and promoting new and improved plants, as well as improving cultural methods and management techniques for conserving our vital natural resources. The primary objectives of the Cape May PMC in producing improved plants for conservation use include:

- Improve water quality.
- Reduce excessive cropland erosion.
- Reduce coastal shoreline and tidal bank erosion.
- Conserve natural resources in urban and rural areas.
- Improve organic waste management techniques
- Improve grassland management techniques and forage quality
- Improve habitat for fish and wildlife

Although, the Cape May PMC has traditionally concentrated on reducing coastal sand dune and tidal bank erosion, the use of plant materials to improve water quality and establish wetlands has become the priority for its service area. The Cape May PMC will meet these newly prioritized objectives as we enter into the new decade of the 90's. The procedure by which the center develops and promotes plant materials to meet such objectives is as follows:

-- Collect and evaluate plant materials including native collections, foreign plant introductions and strains from plant breeders.

-- Increase seed and/or plants of potential new releases.

-- Determine cultural requirements of needed plant materials.

-- Make off-center plantings on problem sites to obtain information on plants for eventual use on these sites.

-- Provide plant propagules for field plantings to Soil and Water Conservation Districts where the final evaluation of a new plant is to be made.

-- Develop, name and release new varieties in cooperation with the New Jersey Agricultural Experiment Station or other cooperating agencies.

-- Maintain and produce breeder or foundation seed or stock of released varieties at the center in accordance with standards of the cooperating agency.

Location & Site Description

The Cape May Plant Materials Center is located in Cape May County which is New Jersey's southern most county. The center is approximately 24 miles south of Atlantic City, New Jersey sandwiched between the Garden State Parkway and US Route 9. Approximately, 500 feet east of the PMC starts the tidal marsh which surrounds Great Sound, a body of water lying between the PMC and the Borough of Avalon.

The climate at the Cape May PMC varies from semi-humid to semi-maritime conditions with average precipitation at 41 inches. During periods when precipitation is below normal, a deep 5.5 acre pond, on the PMC, is utilized for irrigation. The average annual maximum and minimum temperatures at the PMC are 63^F and 44^F, respectively. The Cape May PMC lies in Plant Hardiness Zones 7b, with approximately a 190 day growing season.

The soils on the Cape May PMC are the product of wind mixed marine soils and glacial outwash which has weathered since the Pleistocene Age. The Downer, Sassafras, Fort Mott, and Woodstown soil series are all found on this property with the Downer and Sassafras predominating the acreage. The soils on the Cape May PMC can be generally described as nearly level, well drained, with low to moderate naturally fertile soils which are found at higher land locations. These soils encountered at the Cape May PMC are usually strongly acid in their natural state. The surface feature of these soils ranges from sand to loamy sand. Most fruits and vegetables can be grown on these soils but irrigation is a necessity to insure success. The elevations of the PMC range from 12 to 22 feet above sea level, with slope not exceeding one percent. The four soil series listed above have Soil Capability Classes ranging from I for the Sassafras series

to III for the Fort Mott series. When trees are considered for production, the site indices for native oak, hickories, gums and pines range from 66 to 85.

Agricultural operations are predominantly cash row crops, orchards, truck crops, specialty crops, and poultry. Livestock enterprises have disappeared from many farms which have switched to continuous cultivated crops. This trend to cash crop operations has reduced the use of hay and pasture plants in the cropping systems. Clean cultivation on large tracts of land has increased soil erosion. The problem is especially prevalent on large open areas of flat sandy soils and all sloping land during periods of inadequate soil cover.

Nonagricultural activities play a dramatic role in the use of conservation plants. There is a large portion of this area covered by hardwood and pine forests, much of which is not managed. Extensive areas of tidal marsh are vital to the seafood and wildlife resources which are essential to this area's economy. Also, sand and gravel mining, expanding land transportation systems, increasing number of recreational facilities, and construction of industrial as well as residential developments, are all areas where plants can be used to stabilize disturbed sites.

Fifteen percent of the nation's population lives within commuting distance of the area served by the center. In most areas, an extensive summer resort industry has expanded into a year-round enterprise, creating a demand for high use recreational facilities.

A map illustrating the distribution of the Cape May PMC's Off-Center project sites follows which indicates the PMC's current workload (See Off-Center Project Location Map). The area served by the Cape May PMC includes the mid-Atlantic plain and the piedmont area, extending from Cape Cod, Massachusetts to Sunset Beach, North Carolina (See Service Area Map). The Major Land Resource Areas within the service area are listed below under the nine states each is associated with.

Massachusetts

- 143 - Northeastern Mountains
- 144A - New England and Eastern New York Upland, Southern Part
- 144B - New England and Eastern New York Upland, Northern Part
- 145 - Connecticut Valley
- 149B - Long Island, Cape Cod Coastal Lowland

Connecticut

- 144A - New England and Eastern New York Upland, Southern Part
- 145 - Connecticut Valley

Rhode Island

- 144A - New England and Eastern New York Upland, Southern Part

New York
- 149B - Long Island - Cape Cod Coastal Lowland

New Jersey
- 144A - New England and Eastern New York Upland, Southern Part
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain

Maryland
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain
- 153B - Tidewater Area
- 153C - Mid-Atlantic Coastal Plain

Delaware
- 148 - Northern Piedmont
- 149A - Northern Coastal Plain
- 153C - Mid-Atlantic Coastal Plain

Virginia
- 133A - Southern Coastal Plain
- 136 - Southern Piedmont
- 153A - Atlantic Coast Flatwoods
- 153B - Tidewater Area
- 153C - Mid-Atlantic Coastal Plain

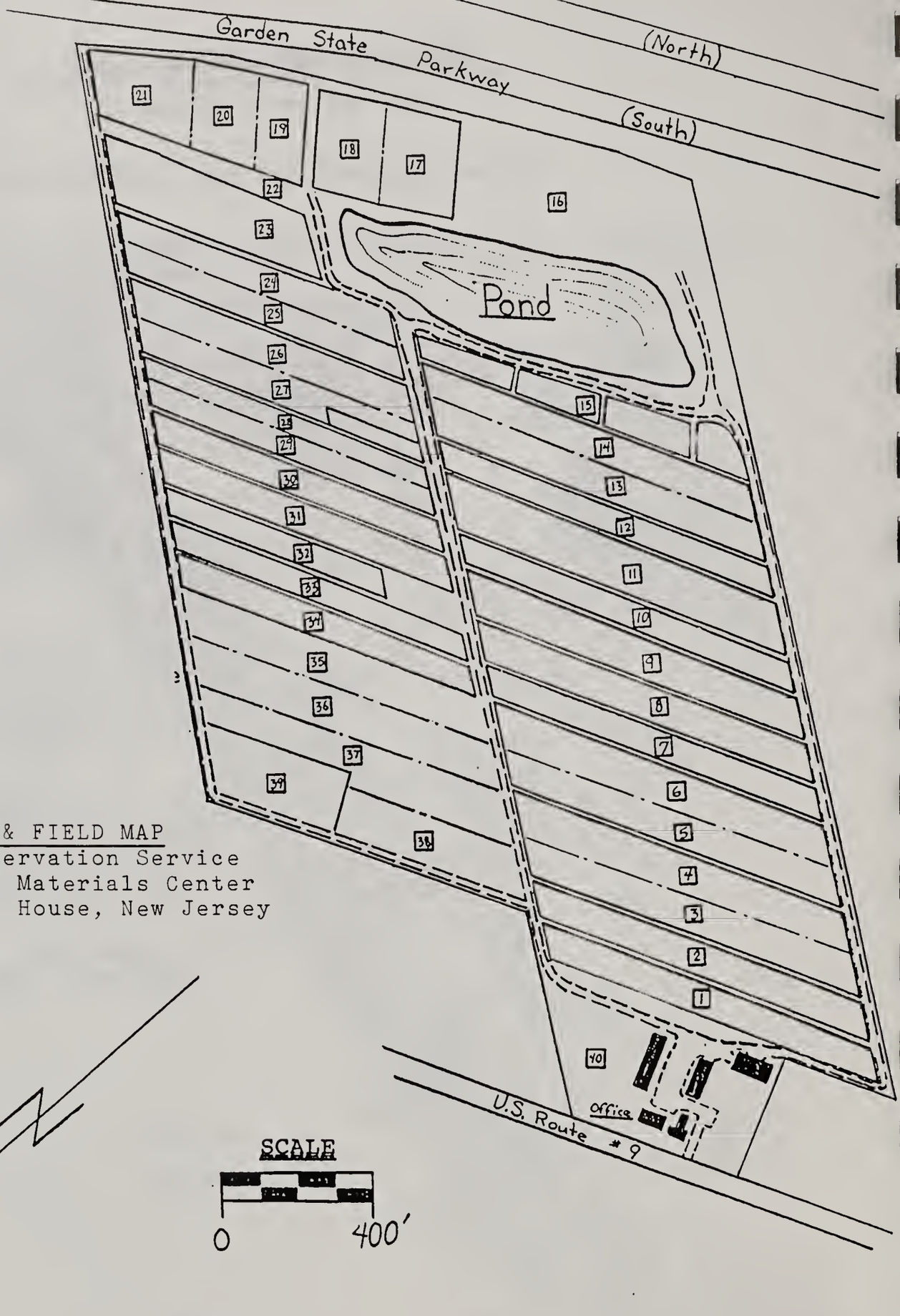
North Carolina
- 133A - Southern Coastal Plain
- 136 - Southern Piedmont
- 153A - Atlantic Coastal Flatwoods
- 153B - Tidewater Area

CAPE MAY - PMC LOCATION MAP

USDA - Soil Conservation Service

Cape May Court House, NJ





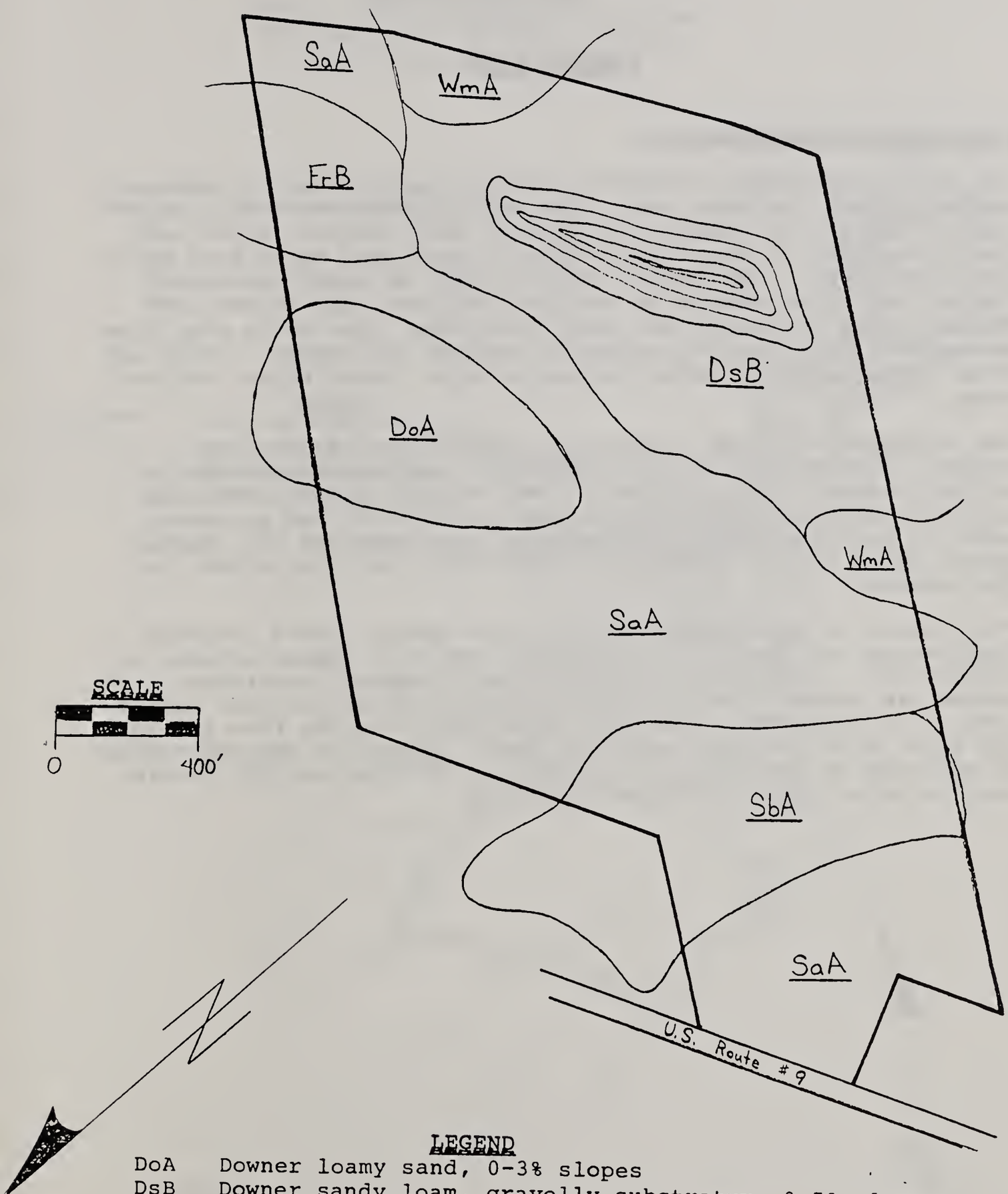
1991 PROPERTY & FIELD MAP
USDA-Soil Conservation Service
Cape May Plant Materials Center
Cape May Court House, New Jersey

SCALE
0 400'

LEGEND
- Field Number
- Access Lane
- PMC Buildings
- Field Divisions (No Field Border)
- Pond

CAPE MAY - PMC SOILS DELINEATIONS

USDA - Soil Conservation Service
Cape May Court House, NJ



LEGEND

DoA	Downer loamy sand, 0-3% slopes
DsB	Downer sandy loam, gravelly substratum, 0-5% slopes
FrB	Fort Mott sand, 0-5% slopes
SaA	Sassafras sandy loam, 0-2% slopes
SbA	Sassafras sandy loam, water table, 0-2% slopes
WmA	Woodstown sandy loam, 0-2% slopes
	Pond

SERVICE AREA

Description of Service Area

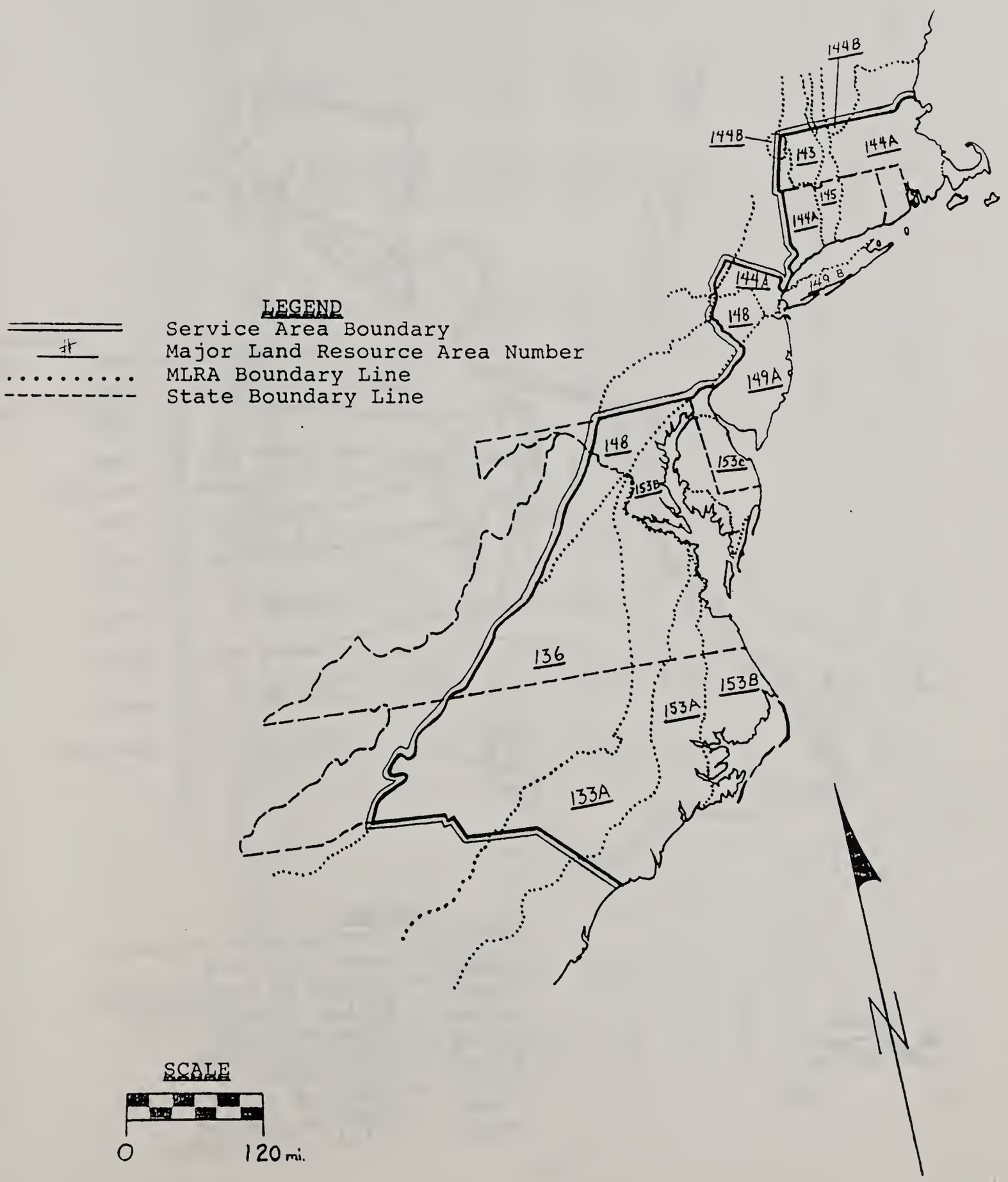
The soils, topography, climate, and land use combine to produce a distinct plant resource area. The soil-forming materials include glacial outwash and underlying beds of sand, gravel, silt, and clay. Problems in this area include active sand dunes that exist along the coast, wind erosion which occurs on sandy cultivated fields, and water erosion on sloping cropland, and stream bank erosion which threatens the tidal estuaries. The soils vary from excessively well drained to poorly drained and swampy. There are large tracts of tidal marsh bordering bays, river inlets and the ocean.

The topographic relief ranges from large areas of level or slightly sloping land to less extensive sections of moderately rolling ridges. The relatively level coastal plain rises from sea level to elevations of more than 600 feet in the piedmont. Level to gently undulating topography characterizes the coastal plain, while gentle slopes and steep ridges are predominant in the piedmont.

The climate is tempered by the Atlantic Ocean. There are wide fluctuations in annual precipitation, and to a lesser extent, in temperature. Drought years do occur and tropical hurricane storms are common. Mean annual precipitation in the area ranges from 38 to 46 inches. The frost-free season varies from 170 to 250 days, with the mean being 192 days. Length of growing season is affected by latitude and elevation. The Cape May PMC Service Area includes Plant Hardiness Zones 5-9.

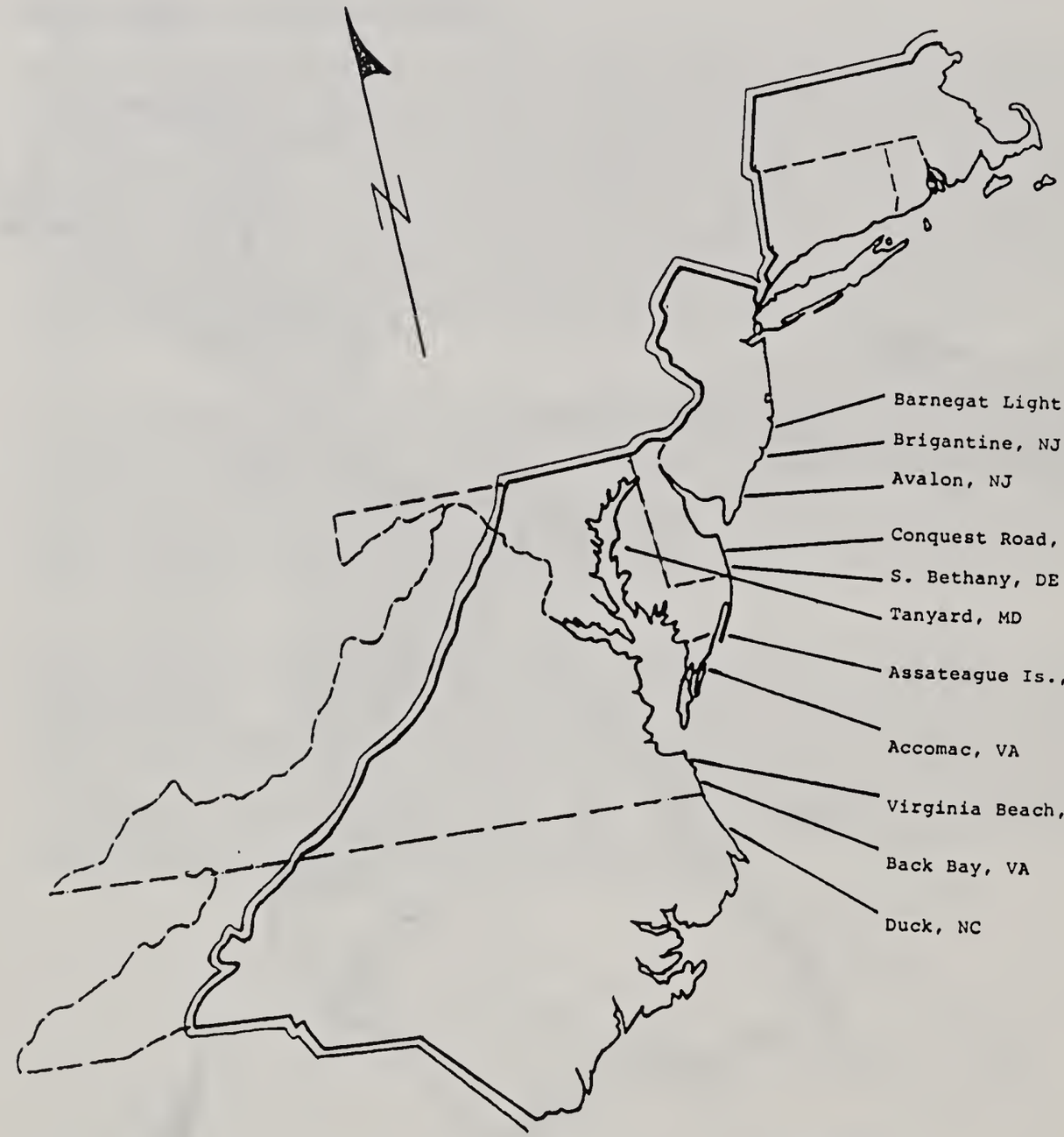
SERVICE AREA MAP

USDA - Soil Conservation Service
Cape May Plant Materials Center
Cape May Court House, NJ



OFF-CENTER PROJECT LOCATION

USDA - Soil Conservation Service
Cape May Plant Materials Center
Cape May Court House, NJ



SCALE

0 120 mi.

LEGEND

Service Area Boundary

State Boundary

* AMBR -- Ammophila breviligulata
* MYPE -- Myrica pensylvanica
* PAAM -- Panicum amarum
* PRMA -- Prunus maritima
* RORU -- Rosa rugosa
* SPAL -- Spartina alterniflora
* SPPA -- Spartina patens
* UNPA -- Uniola paniculata

WEATHER RECORDS AT CAPE MAY PLANT MATERIALS CENTER FOR 1991

Month	Air Temperature °F					4" Soil Temperature °F					Precipitation			
	Maximum			Minimum		Maximum			Minimum		Total	Devi-	Greatest	No.
	Ext.	Av.	Deviation	Av.	Ext.	Ext.	Av.	Deviation	Av.	Ext.	Inches	ation	Daily	Days
Jan.	58	45	+ 4	+ 2 25	08	47	39	0	- 2 35	32	5.20	+1.70	1.90	11
Feb.	69	50	+ 7	+ 5 30	17	47	42	+ 3	- 1 36	33	1.76	-1.26	.37	9
March	78	53	+ 3	+ 2 35	24	57	46	0	- 3 39	34	5.68	+2.12	2.25	10
April	83	63	+ 3	+ 2 43	28	67	57	+ 1	- 3 47	39	4.52	+0.87	2.21	7
May	91	76	+ 7	+ 6 56	37	84	72	+ 6	+ 1 61	54	1.40	-2.32	.66	5
June	95	82	+ 3	+ 1 61	44	87	79	+ 2	- 3 67	60	1.02	-2.13	.39	5
July	101	86	+ 2	+ 3 69	59	92	80	+ 2	- 3 74	68	2.63	-0.12	1.46	6
Aug.	91	84	+ 1	+ 3 67	59	87	82	+ 1	- 3 73	70	2.93	-0.10	1.14	7
Sept.	91	79	+ 2	- 1 57	41	85	77	+ 2	- 4 66	55	3.32	+0.62	1.25	10
Oct.	81	67	+ 1	+ 1 46	31	70	62	- 3	- 7 53	46	1.84	-1.46	1.34	8
Nov.	75	54	0	- 1 38	22	60	51	- 2	- 7 43	32	0.99	-2.46	.65	4
Dec.	67	51	+ 5	0 29	15	54	44	0	- 4 37	32	4.14	+0.51	.91	7
1991	101	66		46	08	92	61		53	32	36.43	-4.03	2.25	89
Normal*		63		44			60		56		41			

*Normal based on:

26 yr. Air Temperature Average; 22 yr. Soil Temperature Average; 26 yr. Precipitation Ave.

Frost free days 198 - April 5 to October 21, 1991. Normal 192 days.

3.7 inches of snow fell on two days (3.5 on Jan. 8 and .20 on February 26, 1991.)

WATER QUALITY PROJECTS

1. PLANT CHEMICAL RECLAMATION PROJECT

2. INITIAL EVALUATION OF SWEET VERNALGRASS (ANTHOXANTHUM ODORATUM)

3. PROPAGATION TECHNIQUES FOR PERENNIAL WETLAND PLANT SPECIES OF THE NORTHEASTERN UNITED STATES

1991 Progress Report of the Plant Chemical Reclamation Project for Cape May Plant Materials Center

Vegetative filter strips have been used in the past to uptake excess nutrients, such as nitrates, before they reach the ground or surface waters. The objective of this project is to develop a plant materials list identifying the best possible plants for vegetative filter strip use under varying site conditions and management practices.

The following is a summary of the activities that took place during the calendar year of 1991 for the Plant Chemical Reclamation Project.

Water Collections

Eighteen water collections occurred during 1991. There were four collections in January, one in February, three in March, three in April, one in each of the months of May, July, August and November, and two in December. The precipitation during the rainfall events ranged from 0.05-3.40 inches. The water samples were shipped to the University of Rhode Island for analysis of nitrate-nitrogen concentration.

Cutting Treatments and Tissue Collections

Three HARVEST treatment cutting dates of 1991 were: May 15 and 16; July 17; and September 13 and 17. Following the cuts, the clippings were removed from these plots.

All the cool-season grasses received a cut on May 15 and 16 while the warm-season grasses did not. For the July 17 cut, the two warm-season grasses were cut along with two cool-season grasses: Matua prairiegrass (*Bromus willdenowii*) and Palaton Reed Canarygrass (*Phalaris arundinacea*). On the third cutting date of the year, the two warm-season grasses were cut along with all the cool-season grasses with the exception of Repell perennial ryegrass (*Lolium perenne*).

In addition, on the third cutting date of the year, the plots of CLIPPED treatment were cut and the clippings were left on the plots.

On each of the three cutting dates of the year, all plots of the HARVEST and CLIPPED treatments were sampled by clipping a one meter square area, collecting the clippings, obtaining a wet and dry weight and grinding the dried sample. The plant samples were shipped to the University of Rhode Island for analysis of total kjeldahl nitrogen.

Soil Collection

For soil fertility analysis soil samples were collected on April 5, 6 and 8 from all the plots and dried. The water samples were shipped to the University of Rhode Island for analysis of nitrate-nitrogen.

For microbiological assessment, soil samples were collected on April 4, May 22 and November 26 from designated plots and shipped immediately to the University of Rhode Island. The microbial biomass was obtained from these soil samples.

Fertilization and Pest Control

The project received a total of 6 lbs. nitrogen per 1000 sq. ft. in the form of urea during 1991. The first fertilizer application was April 8 at a rate of 2 lbs. nitrogen per 1000 sq. ft. The second and third applications were at a rate of 1 lb. nitrogen per 1000 sq. ft. on May 22 and October 10, respectively. The last application took place on December 11 at a rate of 2 lbs. nitrogen per 1000 sq. ft.

A preemergence herbicide, Team, was applied on the cool-season grasses at a rate of 2 lbs. active ingredient per acre on April 17. No other pest control was used during 1991.

Monthly Precipitation (inches)

Jan.	5.20	May	1.40	Sept.	3.32
Feb.	1.76	June	1.02	Oct.	1.84
March	5.68	July	2.63	Nov.	0.99
April	4.52	Aug.	3.93	Dec.	4.14

The only irrigation applied was one half inch following the May 22 and October 10 fertilization treatments.

Problems

Several unexpected problems presented themselves in 1991. A wild red fox chewed off the tygon tubing of the PVC collection tubes on many of the lysimeters in September and October. The tubing was replaced and soap shavings were scattered around the collection tubes as a deterrent. These proved ineffective and the tygon tubes continued to be destroyed until milk crates were placed over the collection tubes. In addition, many of the lysimeters failed to hold vacuum during the summer and early fall of 1991. The water collections taken in July, August, and November indicated the nonworking lysimeters ranged in number between 36 and 53 depending upon the dates of water collection. On November 1, the outflow assemblies of the collection tubes were exposed by excavation. Troubleshooting all the lysimeters

then followed and revealed that the problem lay either in the lysimeter plates or the neoprene tube leading to the lysimeter plates. The consensus of the two centers, Big Flats and Cape May, and the Univ. of RI felt that the soil above the plate has been too dry thereby preventing a water collection. By early December the problem had corrected itself and all the lysimeters were producing a water sample.

Laboratory Analyses Results

Figure 1 shows graphs of the nitrate-nitrogen concentrations found in the water samples taken from the plots between July 1990 and May 1991. These samples were taken during the establishment year when the grasses were in a juvenile stage. Water samples taken from May to December 1991 were analyzed but graphs were not ready at the time of this report.

The baseline water samples taken in July 1990 shortly after seeding the plots show nitrate-nitrogen concentrations ranging from 20-42 ppm. These high concentrations of nitrate-nitrogen are believed to be due to previous cropping systems which included at least 15 years of production of 'Lathco' flat pea (Lathyrus sylvestris) in this field. In addition, disturbance of the soil due to installation of the lysimeters may have caused some immobilized nitrogen to be mineralized. The nitrate-nitrogen concentrations in the water samples quickly decreased to 5 ppm or less during the winter and spring of 1991 in all the plots.

The water sample analyses provide only a partial picture of the nitrogen cycle occurring in the plots. To obtain a more complete picture, the plant tissue and soil analyses must be studied. Figure 2A-D shows graphs of the nitrate concentrations in the soil for the two cutting treatments, at the 0-12 inch depth and 12-24 inch depth. Figure 2E shows the yearly total of the nitrogen-uptake by leaf tissue of the two treatments. The soil analyses indicate that most of the plots show low concentrations of nitrogen of 5 ppm or less. Cape May's soil type is a loamy sand and the nitrogen is more likely to leach from these soils.

The graph of the yearly nitrogen concentration in the leaf tissue shows in most cases the harvest treatment took up more nitrogen than the clipped treatment. This is to be expected because the grasses in the harvest treatment are continually growing and the new tissue is more aggressive at uptaking nitrogen. At the low end of this graph are the two poor performers, Shelter and Cave-in-Rock switchgrass. These grasses took up only a minimal amount of nitrogen to meet their needs. The good performer, Tribute tall fescue, did not take up the greatest amount of nitrogen into the tissue but the water quality of the leachate collected in the lysimeters in 1991 was very good. This indicates that the fertilizer put on Tribute was partly taken up into the tissue and very little of the remaining nitrogen was leached away. What happened to the rest of the nitrogen? We feel that the soil microbial population caused the remaining nitrogen to undergo denitrification. Further research needs to be done on the root physiology of Tribute to determine why this is occurring and what is the carbon source in the plant exudate. The remaining grasses at Cape May are in the acceptable performer category. Palaton Reed canarygrass transported a lot of the nitrogen to the tissue but the water quality was modest. Park Kentucky bluegrass uptakes nitrogen well in May and June, fair in the fall but poor during the summer. Also, the morphology of bluegrass is such that it will not retard water that runs onto it, instead it will flatten down. Matua prairiegrass does well early in the season and then goes dormant in the summer. If Matua is to be used in a filter strip, it must be managed properly. It takes up a lot of nitrogen in the tissue and should be harvested and removed from the filter strip thereby preventing the nitrogen from entering the system again. The two orchardgrasses, Potomac and Comet, do a fair job of uptaking nitrogen throughout the season. The orchardgrasses also have a good morphology for slowing down water that runs onto it. The sweet vernalgrass performs in the spring and fall. This grass has a lot of variability of form and selection and breeding work may increase its potential to uptake nitrogen. Repell perennial ryegrass uptakes a fair amount of nitrogen in the tissue but the water quality of the leachate is not very good. What nitrogen Repell cannot capture, it lets go.

It will be interesting to see if the same trends are found during the 1992 growing season.

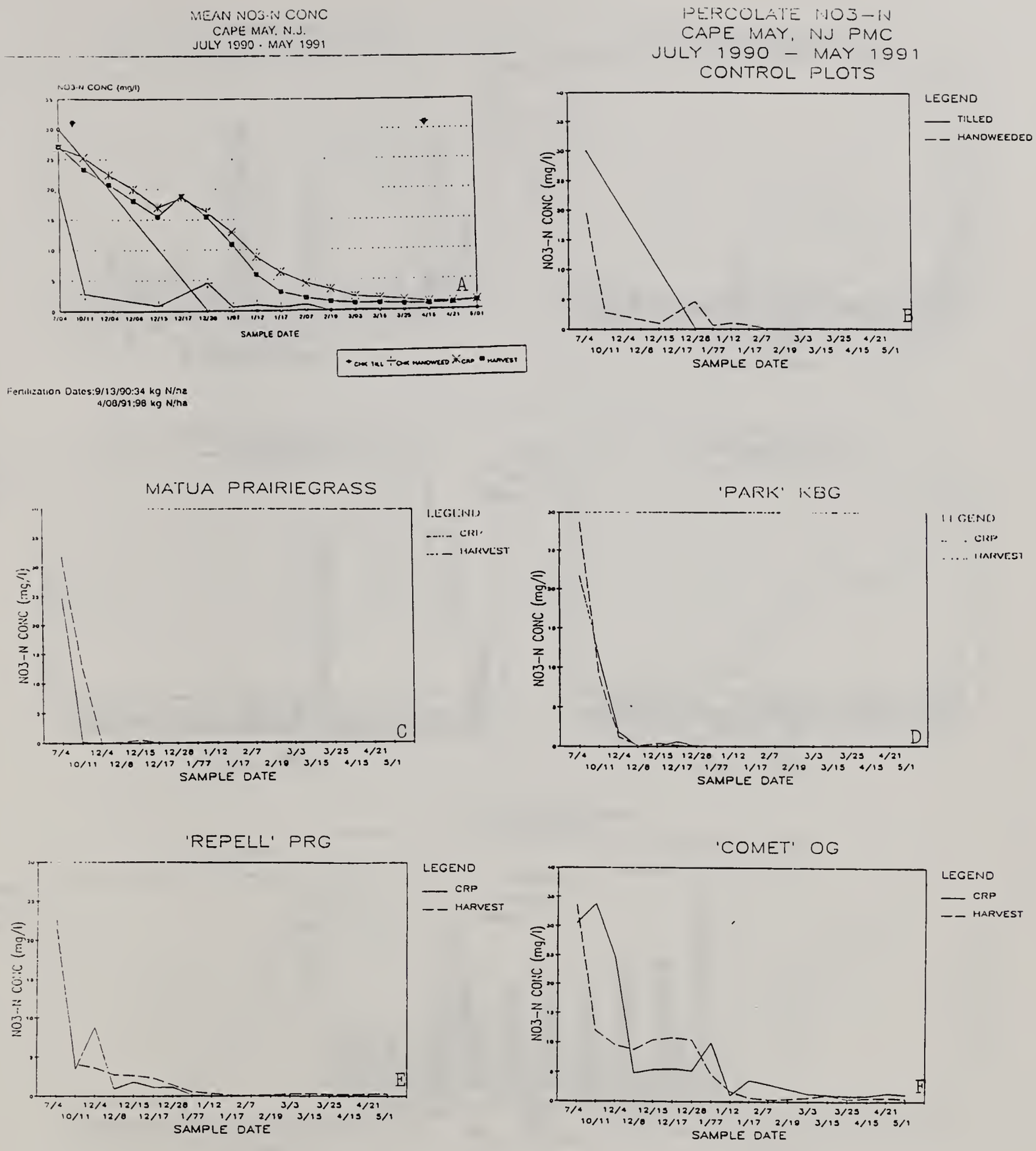


Fig. 1 Nitrate-nitrogen concentration of water samples taken from Cape May PMC between July 1990 and May 1991. Mean concentrations (A) with arrows showing fertilization dates. Concentrations found in plots from control (B), Matua prairiegrass (C), 'Park' Kentucky Bluegrass (D), 'Repell' perennial ryegrass (E), and 'Comet' orchardgrass (F).

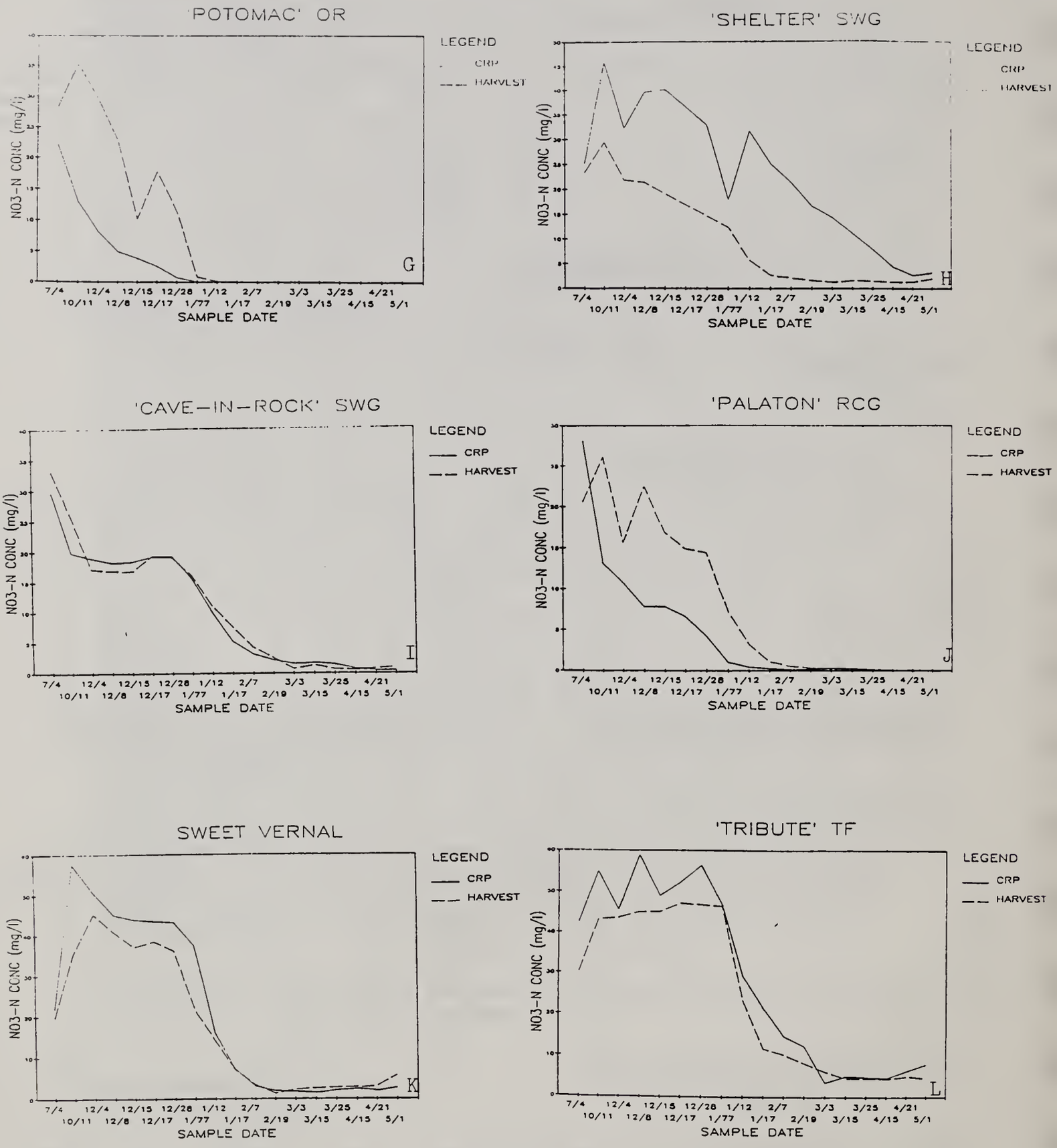


Fig. 1 (cont.) Nitrate-nitrogen concentrations found in water samples from plots of 'Potomac' orchardgrass (G), 'Shelter' switchgrass (H), 'Cave-in-Rock' switchgrass (I), 'Palaton' Reed canarygrass (J), sweet vernal (K), and 'Tribute' tall fescue (L).

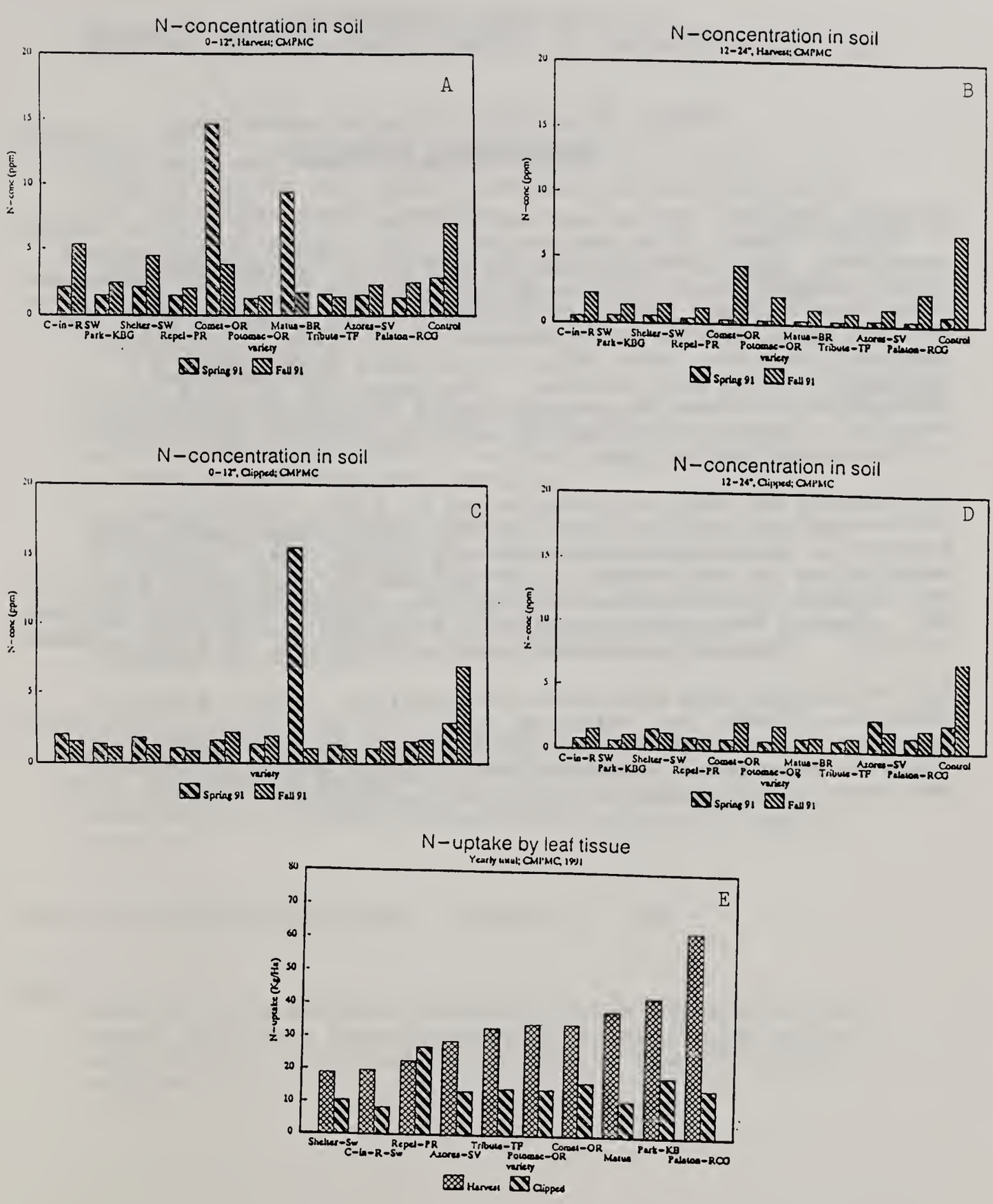


Fig. 2A-D Nitrate-nitrogen concentration of soil samples taken from Cape May PMC spring and fall of 1991. Mean concentrations found in harvest plots at 0-12 inch depth (A), and 12-24 inch depth (B), mean concentrations found in clipped plots at 0-12 inch depth (C), and 12-24 inch depth (D), nitrogen concentration of leaf tissue samples from 1991(E).

INITIAL EVALUATION OF SWEET VERNALGRASS (*ANTHOXANTHUM ODORATUM*)

Nitrate leaching into ground and surface water is a major concern of recent times. This contamination can result from cropland practices, home lawn maintenance and animal waste disposal among other things. One approach of reducing nitrate contamination of ground and surface water is the use of plant species that have abiliities to uptake large amounts of nitrates. University research has shown that sweet vernalgrass (*Anthoxanthum odoratum*) is one such species. The objective of this initial evaluation of sweet vernalgrass is to identify and develop a superior cultivar for release, which can be utilized for vegetative filter strips.

An assembly of fifty-six accessions of sweet vernalgrass was planted into Field 2 of the Cape May PMC in September 1990. Forty-nine accessions were surviving during 1991. Sweet vernalgrass is one of the first cool-season grasses to green up and flower. This occurred during late March-early April at the PMC. During the summer of 1991, the accessions went into summer dormancy. Several accessions died out during this dormancy.

All accessions were evaluated for survival, vigor, foliage abundance, cover, and relative rank. The majority of the accessions were similar in these parameters, but several better accessions could be observed. This grass will continue to be evaluated until a superior cultivar is chosen.

PROPAGATION TECHNIQUES for PERENNIAL WETLAND PLANT SPECIES of the NORTHEASTERN U.S.

Problem:

Land Use - wetland mitigation sites, artificial wetlands, ponds and natural wetland species diversity, and streambank stabilization

Resource Concerns - successful establishment of vegetation in wetland conditions; there is an increase of artificial wetland construction; it is thought that wetland plants take part in extracting excess nutrients from surface water

Conservation Practices Effected - constructed wetlands, storm water detention basins, manure mgt. systems, ponds, water-ways, natural wetland mgt., streambank protection, nutrient mgt. systems

Quantitative Magnitude - The states served by the CM-PMC have all expressed the lack of information pertaining to the establishment of vegetation in constructed wetlands. Wetland concerns are relatively new with many unanswered questions; the CM-PMC has the resources to investigate some of these questions.

Objective:

The identification of successful wetland plant propagation techniques and factors which limit success are the primary intent of this project with the possibility of Water Quality implications for certain species.

Advisory Committee Approval - October 23, 1991

Goal:

Develop and distribute Technical Notes explaining the proper procedure for successfully establishing wetland vegetation in constructed wetlands to the SCS field offices

STUDY PLAN

Planting Unit Size for Wetland Plants

Objective: Determine the minimum vegetative planting unit size of ten wetland plant species to successfully establish good stands in one and two growing seasons.

Literature Search: March 1992

Location: Cape May PMC

Time Frame: Five year study starting in 1992

Plant Materials:

1. Ten species in study:

Alisma plantago-aquatica	(common water plantain)
Juncus effusus	(soft rush)
Peltandra virginica	(arrow arrum)
Phalaris arundinacea	(reed canarygrass)
Pontederia cordata	(pickerel weed)
Sagittaria latifolia	(duck potato)
Scirpus acutus	(hardstem bulrush)
Scirpus cyperinus	(wool grass)
Scirpus validus	(softstem bulrush)
Sparganium eurycarpum	(giant burreed)
Typha sp.	(cattail)

2. Assemble 20 units of each species of native and commercial origin (spring 1992)
3. All material will be assembled in the south pit of field 15 at the CM-PMC as an increase block (1992)
4. The study will be evaluated in the north pit of field 15 (1993)
5. Planting Units:
   a. Planting units of commercial sources will be used in 1993 as a standard of comparison
   b. 1/2 the size of the commercial nursery stock will be utilized for comparison of each species
   c. 1/4 the size of the commercial nursery stock will be utilized for comparison of each species

North Pit Preparation: (1992)

1. Level field to ensure uniform water depth in study
2. Plant oats as summer and winter cover crop; disc prior to seed formation
3. Lightly disc 20 bags of peatmoss into study area

Plot Design:

1. 10 species
2. 10 plants per species
3. 3 planting unit sizes

4. 3 replications
5. Plant Spacing:
    a. in row: 2 ft.
    b. between row same species: 2 ft.
    c. between species: 3 ft.
6. Borders: 3 ft.
7. Study Dimensions: 73 ft. x 66 ft.

Analysis / Evaluations:

1. % Survival
2. Vigor (1-9; 1=excelent)
3. Foliage Abundance (1-9; 1=very abundant)
4. % Cover (1-9; 1=91-100%)
5. Insect, Disease, & Frost Injury (1-9; 1=no injury)
6. September Dimensions:
    a. canopy width (cm)
    b. foliage height (cm)

Maintenance:

1. Apply 300lbs. of 10-10-10 fertilizer per acre in May
2. Weed Control- hand weed as needed

Reports:

1. Data will be recorded monthly from May until October
2. Annual Technical Summarization completed by December of each year
3. Enter summary in CM-PMC Annual Report to Field Offices
4. Enter Data on Computer

Staffing:

	Professional Hours	Technical Hours	Total Hours
Assembly*	35	0	35
Site Preparation	0	20	20
Planting	25	10	35
Evaluation	40	0	40
Maintenance	0	30	10
Reports	20	0	20
Total	120	60	180

* only scheduled for 1992

1991
SAND DUNE RESTORATION PROJECTS

1. INITIAL EVALUATION OF SEA OATS (*UNIOLA PANICULATA*)

2. WOODY PLANTS FOR SAND DUNE RESTORATION:
   a. ADVANCED EVALUATION OF BEACH PLUM (*PRUNUS MARITIMA*)
   b. ADVANCED EVALUATION OF BAYBERRY (*MYRICA PENSYLVANICA*)
   c. ADVANCED EVALUATION OF RUGOSA ROSE (*ROSA RUGOSA*)

3. EVALUATION OF AMERICAN BEACHGRASS (*AMMOPHILA BREVILIGULATA*) FOR LONGEVITY

4. EVALUATION OF BITTER PANICGRASS (*PANICUM AMARUM*) FOR SAND DUNE RESTORATION

5. EVALUATION OF SALTMEADOW CORDGRASS (*SPARTINA PATENS*) ON SAND DUNES

INITIAL EVALUATION OF SEA OATS (UNIOLA PANICULATA)

Sea oats (Uniola paniculata) is a warm season, perennial bunchgrass that is the dominant native foredune species of the coastal strand environment extending from Northampton County, Virginia south to Florida and the Dry Tortugas in the Caribbean and west to Texas and the Gulf states of Mexico. In addition to being dominant on the frontal dune, sea oats occur through the back dune and rear depressed areas of the coastal ecosystem, where they are commonly found with bitter panicgrass (Panicum amarum) and saltmeadow cordgrass (Spartina patens).

Both the above and below ground portions of sea oats help to trap and accumulate sand, resulting in small dunelets forming around the plants. As both the number of sea oats and the number of dunelets increase, a barrier is created against storm-generated waves. In addition, the spread of the plants' extensive rhizome system helps to prevent the deflation of existing dunes.

Many authors have noted that diverse planting mixtures are preferable over monocultures for promoting stand longevity, pest resistance, and the ability to withstand environmental degredation. Sea oats is considered to be excellent for companion planting with American beachgrass (Ammophila breviligulata) and bitter panicgrass (Panicum amarum). As consequence of sea oats being a warm-season (C4) grass and American beachgrass being cool-season (C3), mixed plantings offer a maximum amount of yearly growth and, hence, sand-binding ability. Although the increased rate of tillering for American beachgrass allows for faster establishment, sea oats tends to outlive and take over beachgrass plantings over time. Sea oats tends to remain more vigorous than does American beachgrass under conditions of reduced fresh sand accumulation. In addition, sea oats has been noted as much more resistant to marasmius blight than is American beachgrass, bitter panicgrass, or coastal panicgrass.

The Cape May PMC began the evaluation of sea oats in 1982 with the dual objective of selecting an ecotype with cold-tolerance and selecting/breeding an ecotype with superior vigor. Currently, there are 47 accessions located in various evaluation sites in Virginia, Delaware, and New Jersey. Twenty five (25) accessions were chosen in 1990 for evaluation for increased cold-tolerance. A twenty-sixth accession was added to the previous 25 selections after being bred in a random pollination nursery composed of several of the most promising ecotypes. In June of 1990, the 25 accessions were planted in a replicated evaluation for Northern range at Barnegat Light, New Jersey. A second replicated planting including all 26 potential cold-tolerant ecotypes was planted in Avalon, New Jersey during June of 1991.

Sixteen (16) ecotypes were chosen in 1990 for continued evaluation for superior vigor. Interestingly, all but six of the sixteen accessions were previously chosen for inclusion in the evaluation for Northern range. The sixteen ecotypes with potentially superior vigor were planted in June of 1991 in a replicated planting located at Delaware Seashore State Park.

The five best accessions of sea oats in the active projects include:

Original Accessions No./ 1/2-Sib Progeny Accession No.
9039033/9061202
9041959/9061173
9041976/9061181
9039013/9061168
9030201/9061165

These five accesisons were found in three or more of the five projects reviewed or were found in the top five of two projects. Since the winter of 1990-91 was relatively mild, most accessions experienced fair to good survival. The normal winters to come will truly test the northern adaptation and superior vigor of this southern dune species.

The 1991 Avalon, New Jersey planting was subjected to two high tide floodings during storms of October 31 and November 10. A third high tide flooding occured on January 4, 1992. The results of the flooding caused several inches of sand to be deposited over the plants. As a result, the survival of this study is in question and will be revealed during the spring and summer of 1992.

Additional studies in 1992 will:

1.) Compare the resultant vigor, foliage production, and dormancy tendencies of establishment with 30 grams per hill of 19-6-12 slow-release osmocote as compared to broadcast with 500 lb. per acre of 10-10-10 fertilizer. This study will be located at Delaware Seashore State Park.

2.) Compare 26 cold-tolerant ecotypes in a replicated study in New Jersey.

Sea Oat Accessions Included in the CM PMC Initial Evaluation for Northern Range and Superior Vigor

Original Acc. No. [1/]	1/2-sib Progeny No. [2/]	Original Collection Site	Included in Cold-Tolerance Evaluation [3/]	Included in Superior Vigor Evaluation [4/]
9027034	9061156	Back Bay, VA	yes	yes
9027035	9061157	VA Beach, VA	yes	yes
9027036	9061158	VA Beach, VA	no	yes
9030194	9061159	Cape Charles, VA	yes	yes
9030195	9061160	Accomack, VA	no	yes
9030199	9061163	VA Beach, VA	yes	no
9030201	9061165	VA Beach, VA	no	yes
9030203	9061167	VA Beach, VA	yes	no
9039013	9061168	Northampton, VA	yes	yes
9039031	9061169	Carteret, NC	yes	yes
9039033	9061202	Georgetown, SC	yes	yes
9039034	9061170	Georgetown, SC	yes	no
9039036	9061171	Georgetown, SC	no	yes
9039037	9061172	Georgetown, SC	no	yes
9041959	9061173	Charlestown, SC	yes	yes
9041960	9061243	Charlestown, SC	no	yes
9041961	9061174	Dare, NC	yes	no
9041969	9061203	Currituck, NC	yes	yes
9041970	9061175	Dare, NC	yes	no
9041971	9061176	Dare, NC	yes	no
9041972	9061177	Dare, NC	yes	no
9041973	9061178	Dare, NC	yes	no
9041974	9061179	Dare, NC	yes	no
9041975	9061180	Dare, NC	yes	no
9041976	9061181	VA Beach, VA	yes	yes
9041977	9061182	VA Beach, VA	yes	no
9041979	9061184	VA Beach, VA	yes	no
9041981	9061186	VA Beach, VA	yes	yes
9041983	9061188	VA Beach, VA	yes	no
9041984	9061189	VA Beach, VA	yes	no
9041985	9061190	VA Beach, VA	yes	no
9061242	-------	CM PMC Random-X Cape May, NJ	yes	no

1/ Represents the accession number assigned to ecotype at the time of initial collection.

2/ Represents the accession number assigned to 1/2-sib progeny from the original ecotype.

3/ Evaluation for cold-tolerance includes 26 accessions total.

4/ Evaluation for superior vigor includes 16 accessions total.

WOODY PLANTS FOR SAND DUNE RESTORATION

In the mid '60's, when the Cape May Plant Materials Center was established, great emphasis was placed on controlling coastal beach erosion. A major achievement of that time period was the development of 'Cape' American beachgrass (Ammophila breviligulata). This grass is a pioneer species but acclimated to shifting frontal dunes. The large expanse of secondary sand dunes has since been identified as the vegetative zone which is capable of withstanding powerful wave action, providing the last protective barrier to population centers. This backdune zone is predominantly stocked with shrub and small tree species.

Assemblies of the most common shrubs and trees, native to sand dunes of MLRA 149 and 153 were organized in 1979. Three of those woody dune plants are still being evaluated for use in stabilizing the backdune area. These species are beach plum (Prunus maritima), rugosa rose (Rosa rugosa) and bayberry (Myrica pensylvanica). All three species are currently being evaluated for survival, vigor, foliage abundance, insect and disease resistance, fruit production, and plant dimensions. The intent of such evaluations is to develop a superior cultivar for each species which would be released onto the commercial market. These woody releases will add to the diversity of the list of plants used to combat beach erosion.
By the end of the 1991 evaluation season, the 1990 Brigantine, New Jersey beach plum planting was terminated due to excessive browsing by cottontail rabbits. All stems at this site were eaten to the root collar. It is our recommendation to monitor rabbit population in areas where beach plum is intended for planting. In addition, the 1988 Barnegat Light, New Jersey planting was terminated because of repeated floodings from being located in a low area. The two remaining evaluation sites for beach plum in Delaware and North Carolina continue to provide good comparison of the four accessions being viewed. Current intentions are to put in a new planting in New Jersey and to continue observing and comparing the four acessions through the advanced evaluation period, then consider the evaluation and release of a random cross of all four accessions.

Seed from rugosa rose (9051590) on the other hand, has been the product of a polycross nursery at the Cape May PMC for the last four years. In the spring of 1990, an off-center planting was installed at Brigantine Beach in New Jersey. This planting employs two replications comparing seedlings of 9051590 to a commercially produced variety. The parameters evaluated in this comparison include number surviving, vigor, foliage abundance, insect and disease injury, and plant dimensions. In both 1990 and 1991 evaluations at Brigantine, New Jersey, 9041590 was rated higher for overall performance than the commercial stock.

The first off-center planting of bayberry was installed at Brigantine Beach in New Jersey during the spring of 1990. The plants installed at this site were 2/0 seedlings which were between 12 and 18 inches tall. There were four accessions used in this study; ten plants from each were planted. During the spring of 1991, another planting of bayberry was installed at Brigantine, New Jersey. Although the 1990 planting failed at this site, the 1991 planting yielded good consistent data for all four accessions. The average percent survival for this planting was 66% with a range from 30% to 90%. The best accession at this site was 434150 followed closely by 548966.

EVALUATION OF AMERICAN BEACHGRASS (*AMMOPHILA BREVILIGULATA*) FOR LONGEVITY

American beachgrass (*Ammophila breviligulata*) is the dominant foredune plant from Virginia north to Nova Scotia. In addition, American beachgrass is also the species used most for the initial stabilization of the frontal dune portion of the Mid-Atlantic coast. Released from the Cape May PMC in 1972, the cultivar 'Cape' is considered to be superior for restoration use north of the Chesapeake Bay. However, Cape and other commercial varieties of beachgrass have exhibited a decline in vigor and eventual die-out in some sites despite proper management. The decline and subsequent die-off have been attributed to both insect and disease, but the exact cause of the problem has yet to be determined. As such, the purpose of this project is to compare Cape against other accessions of American beachgrass to note their relative longevity and growth form. It is hoped, that from this comparison, an ecotype can be found or bred that exhibits greater longevity and retains the superior vigor and growth attributes associated with Cape.

Seven (7) accessions are currently involved in the evaluation, including the cultivars Cape, 'Hatteras', and 'Bogue' as well as accessions 9047071, 9047072, 9047073, and 9047085. Hatteras, Bogue, 9047071, and 9047072 originated from the Carolinas, while 9047073 and 9047085 were collected from sites in Virginia Beach, Virginia. Cape American beachgrass was collected in 1965 from Barnstable County, Massachusetts. The 1991 active plantings currently include off-center sites at Duck, North Carolina; Fort Story Army Base in Virginia Beach, Virginia; Back Bay Wildlife Refuge in Sandbridge, Virginia; Brigantine, New Jersey; and Barnegat Light, New Jersey. In addition, the following plantings were established in 1990 on the Cape May PMC:

1.) A replicated comparison of the included accessions for longevity; and

2.) A random crossing block for the development of an additional accession with the potential for increased longevity.

To date, our initial observations suggest that although Cape American beachgrass has an extremely rapid rate of establishment, several of the recent collections may have a greater longevity and/or disease resistance.

In the random crossing block, five of the seven accessions produced seed. The plants from this seed will be grown in an observation nursery at the center during 1992. It is hoped a superior genotype(s) will be identified from this material.

EVALUATION OF BITTER PANICGRASS (*PANICUM AMARUM*) FOR SAND DUNE RESTORATION

Recognizing the longevity problem found in stands of American beachgrass (*Ammophila breviligulata*), the staff of the Cape May PMC began searching for native grasses which grow in association with American beachgrass. In 1983, an assembly of bitter panicgrass (*Panicum amarum*) was made to test its performance on sites where American beachgrass had died out. Bitter panicgrass is a perennial warm season grass that is ideal for complimenting the cool season character of American beachgrass. This vegetatively established dune grass has semi-prostrate growth form and spreads by means of rhizomes; it has excellent sand stabilizing properties. The primary objective of this study is to identify a superior accession of bitter panicgrass that is adapted to the coastal sand dunes of the northeastern and southern United States.

Since the initiation of an assembly in 1983, the number of accessions has dropped from 57 to 3. In current evaluations, the cultivar 'Ocracoke' is used as the commercial standard for comparison. The accessions 515948, 518820, 518821 and Ocracoke are currently being increased at the Cape May PMC for off-center trials. These accessions are currently being evaluated by the area Plant Materials Specialists and the PMC Staff at several off-center locations.

One off-center planting is located at Brigantine Beach, New Jersey. This planting is comprised of two replications of the three accessions under evaluation as well as Ocracoke. This site is a beach front area which is periodically flooded by the high tides. Standing water has been observed in this planting after such flood events. The initial evaluation results reflect the known fact that bitter panicgrass does not tolerate wet soil conditions. High mortality was found where water had ponded for more than 24 hours.

Since its establishment in 1990, much sand has accumulated around and in the planting eliminating the flood threat witnessed in the first year. Of the two replications, only Rep I has all four accessions surviving. In Rep II, there are only two accessions surviving due to previous flood damage. The true test of this planting came the fall of 1991 when strong northeast storms flooded the New Jersey coastline. It will be interesting to see if any or all of these accessions live in 1992.

EVALUATION OF SALTMEADOW CORDGRASS (*SPARTINA PATENS*) FOR DUNE RESTORATION

The detection of decline in the health of American beachgrass (*Ammophila breviligulata*) stands on coastal sand dunes has prompted the realization that pure stands of American beachgrass are not safe from an erosion protection stand-point. A complex of associated herbaceous dune species would be preferred. Such combinations would provide continuous stabilization in the event that pathogens were to reduce or eliminate the effectiveness of one species. The success of saltmeadow cordgrass (*Spartina patens*), as part of such a complex, is being evaluated at one site in New Jersey. It is hoped that this native of the backdune area can survive on the shifting sands of the foredune. This species of cordgrass is very salt and drought tolerant.

At Brigantine Beach, New Jersey, a planting of saltmeadow cordgrass accession 421250 was installed in mid-April, 1990. It was located approximately 150 feet from the surf on a level area of the beach. On the nearby dunes, the predominant native species was American beachgrass. This planting consisted of two replications of 72 saltmeadow cordgrass plants which were surrounded by two border rows of American beachgrass. The last evaluation performed on this planting in 1990 yielded an average rate of 83 percent survival and a moderate rating for foliage production. The survival rate has been affected by abnormally high tides but due to moderate sand accumulation, this tide problem should not threaten the planting further.

After the 1990 growing season, two to three feet of sand had accumulated in this planting. With the onset of the 1991 growing season, the survival of this relocated plant species was still quite high with an average of 70% for both replications. This planting continues to be vigorous and well adapted even into late 1991. Due to the success of this accession at this location, the collection of additional accessions of saltmeadow cordgrass growing on or near the foredune will begin in 1992.

1991 COVER CROP PROJECTS

1. ADVANCED EVALUATION OF WINTER COVER CROPS

2. INITIAL EVALUATION OF EASTERN GAMAGRASS (*TRIPSACUM DACTYLOIDES*)

3. INITIAL EVALUATION OF SAINFOIN (*ONOBRYCHIS VICIAFOLIA*)

ADVANCED EVALUATION OF WINTER COVER CROPS

On soils that are exposed for periods of one to twelve months, it is advisable to plant temporary vegetative cover. This serves as a protective measure to control erosion from wind or rain, runoff or snow melt and controls sedimentation. For these reasons, it is desirable to use cover crops on agricultural fields where bare soil is exposed. In 1983, the Cape May PMC became interested in identifying and releasing one or more winter cover crop species. The cover crop species would be used on conventionally tilled soybean and corn fields as well as on other land used to grow speciality crops such as tobacco, peanuts and vegetables. Often, cover crops are seeded after the main crop harvest, but it is difficult to get good stand establishment following late harvested crops. For this reason, the Cape May PMC is concerned about how late a cover crop can be planted and still provide adequate winter cover.

In 1990, ten accessions which included three bromegrasses (Bromus); one ryegrass (Lolium), two brassicas (Brassica); two accessions of rattail fescue (Vulpia myuros); 'Aroostook' and 'Syn-T' cereal rye (Secale cereale), were planted on September 5 and 26 and October 16. All three plantings achieved fair to good growth by the winter months, thereby, providing good soil cover. The winter of 1990-91 was mild and the only species showing much adversion to the few days of cold weather were the Brassicas which turned from a green to a purple-red and had leaf burn. The September 5 plants had the greatest stand, foliage abundance, and height, percent cover and vigor of the three planting dates followed by the plants of September 26 and lastly, the plants of October 16. The plants of the later two planting dates were slightly more resistant to the cold than the plants of the first planting. It could be speculated that this may be due to the later two plantings having shorter plants during the cold winter months than the plants of the first planting. Since they were closer to the warmer soil, these shorter plants may not have been affected as much by the cold winds as the plants of the first planting.

The top rated winter cover crop species planted in 1990 were the two cereal ryes, Syn-T and Aroostook. Cereal ryes are a conventionally grown winter cover crop species in much of the mid-Atlantic area. Several of the other species in this study provided adequate winter cover and perhaps could be substituted for cereal rye as a winter cover crop. These include Lolium perenne multiflorum, Bromus arvensis, B. cilatus, and B. tectorum. In an attempt to answer the question of how late can a winter cover be planted and still provide adequate cover, the data from the 1990 planting show the last planting date of October 16 provided fair to adequate cover. However, it must be noted that the winter of 1990/91 was mild and these results may not be achieved during harsh fall and winter months.

In 1991, Syn-T cereal rye was omitted from the study and only nine accessions were used. The three planting dates were September 13, October 2 and 17. The data as of this report shows all the accessions at the three planting dates had not achieved the growth they did in 1990. This may be due to temperatures that were not as warm in October through December of 1991 as compared to 1990. In addition, October and November of 1991 were drier than 1990. The very poor performance of the October 17, 1991 planting is probably due to the heavy rainstorm received shortly after the seeding. The initial ratings of the species in the 1991 winter cover crop study showed the same results as 1990 where the cereal rye is the top rated species followed by Lolium and the Bromus species.

INITIAL EVALUATION OF EASTERN GAMAGRASS (*TRIPSACUM DACTYLOIDES*)

Extensive acreage within the Northeast is planted to corn silage. Frequently, the crop is harvested too late to allow for the establishment of adequate winter cover, resulting in widespread soil erosion. The identification and improvement of a perennial grass for use as silage would be of great benefit in reducing the amount of soil lost to field runoff. Soil erosion would be further reduced through the introduction of a highly productive and palatable forage grass for use on marginal cropland.

Eastern gamagrass (*Tripsacum dactyloides*) is a tall, perennial, warm-season bunch grass. Native populations are typically monoecious with the pistillate spikelets located below the staminate on terminal racemes. Distribution is from Massachusetts west to Nebraska, south to Texas and Florida. Eastern gamagrass grows in drainage areas, streambanks, and moist places. The grass is highly productive and extremely palatable, often being greatly reduced in natural stands through preferential grazing. However, widespread use of of Eastern gamagrass has been hindered by low seed production, inferior seed quality, lack of natural persistence, and difficulties with vegetative propagation.

In 1981 a mutant sex form (GSF I) was collected from Ottawa County, Kansas. GSF-I exhibited gymonoecy with pistillate spikelets below and perfect spikelets above. As a result, the number of pistillate spikelets increased by approximately twenty five-fold leading to a large potential increase in the amount of seed production.

The Cape May PMC is currently evaluating 106 accessions of Eastern gamagrass, 59 accessions of which represent native material with normal seed production (monoecious sex form or MSF) and 47 accessions which represent sexually-deviant material (gymonoecious sex form or GSF) received from the USDA/ARS Woodward, Oklahoma Experiment Station. Upon completion of initial evaluation, promising accessions will be entered into a breeding program and examined for the eventual release of a superior Eastern gamagrass accession(s) that is adapted to the mid-Atlantic region.

The 1990 and 1991 data show nineteen (19) gymonoecious sex form (GSF) accessions and fifteen (15) monoecious sex form (MSF) accessions as superior for the Cape May PMC initial evaluation. However, most of the MSF accessions appear to be polyploid, thus further examination is necessary before the initiation of the breeding program.

INITIAL EVALUATION OF COMMON SAINFOIN (ONOBRYCHIS VICIAFOLIA)

Both wind and water erosion forces carry off excessive amount of soil from conventionally tilled cropland which doesn't employ the use of winter cover crops. This also holds true for cropland which lays fallow. Numerous annual grains have been used to control these erosive forces during the non-growing season, such as cereal rye, winter wheat, and oats. The use of permanent cover crops is now being pursued under new conservation tillage concerns. Legumes, in general, offer potentially more than just winter cover, such as the grains listed above; they possess the ability to make more nitrogen available for the primary crop. More available nitrogren overall often results in greater yields. Common sainfoin, one such legume, is currently being evaluated for its permanent vegetative cover attributes. This plant has the potential to be utilized for many conservation activities including critical area stabilization, no-till cropping systems, animal forage, wildlife cover, and permanent cropland cover; as well as revitalizing over-cropped land by adding more organic material and nitrogen fixation. All such uses of this Eur-Asian native will be considered after more is known of its growth characteristics and adaptability to the mid-Atlantic region.

In June of 1990, one hundred and fifty-six accessions were planted at the Cape May Plant Materials Center in twenty foot rows. Within the first growing season, one hundred twenty-seven accessions emerged. The success of those accessions which did emerge varied greatly. It was noted during December of 1990 that this species showed good vigor for most accessions with a vibrant dark green color. In 1991, 120 accessions survived the first winter at the Cape May PMC. The three top accessions of 1990, based upon vigor, foliage, abundance, cover, stem density and survival were again the top three in 1991; they were 313063, 372829, and 401468. In 1991, nine of the top ten accessions were in the top twenty-five of 1990. Visible seed was collected during the spring and summer of 1991. Evaluations will continue throughout 1991 and seed will be collected in the spring.

1991

TIDAL ZONE STABILIZATION PROJECTS

ADVANCED EVALUATION OF SMOOTH CORDGRASS (*SPARTINA ALTERNIFLORA*)

SMOOTH CORDGRASS (*SPARTINA ALTERNIFLORA*) FOR TIDAL BANK STABILIZATION

The banks of river estuaries and coastal sounds are exposed to strong storms and fluctuating water levels and, as result, are undergoing severe erosion problems. The erosion of river estuaries and coastal sounds is extensive in Virginia, North Carolina, Maryland, New Jersey, and Delaware. It is estimated that over 6000 acres of valuable land is being lost from these areas annually.

Smooth cordgrass (*Spartina alterniflora*) is a salt tolerant perennial species which grows in the intertidal zone of saline and brackish marshes and along river banks. The grass is characterized by long, slender, flexible culms and a thick rhizomonous root system. Planted along the shoreline, the smooth cordgrass absorbs wave energy and collects the sediment brought in by the water currents. As the sediment is dropped, the band of vegetation expands, pushing the mean high tide line away from the tow of the bank, reducing the potential for continuing erosion.

The Cape May PMC began initial evaluation of 111 accessions of smooth cordgrass in 1977. In 1988, after evaluation at various planting sites in Virginia and Maryland and after being evaluated in field plantings in North Carolina and New Jersey, three accessions were selected for advanced evaluation: PI-421162, PI-421200, and PI-421228. Release of PI-421162 as a superior smooth cordgrass accession for use in the Mid-Atlantic region is anticipated for 1992. At the time of release, PI-421162 will become the primary plant recommended for use in conjunction with 'Avalon' saltmeadow cordgrass (*Spartina patens*) for the restoration and stabilization of saline/brackish marshes, tidal banks, and river banks.

1991
WIND DIVERSION PROJECTS

EVALUATION OF EASTERN RED CEDAR (*JUNIPERUS VIRGINIANA*) FOR SCREENS AND WINDBREAKS

EVALUATION OF EASTERN RED CEDAR (*JUNIPERUS VIRGINIANA*) FOR SCREENS AND WINDBREAKS

High wind velocity is one of the most damaging natural agents to cropland located along the mid-Atlantic coastal plain. The prevailing currents often cause the transport of soil particles, resulting in erosion and widespread crop damage. Properly established windbreaks have proven effective in helping to reduce surface wind velocity. As such, the objective of this project is to evaluate Eastern red cedar (*Juniperus virginiana*) ecotypes for windbreak potential and to select a rapidly growing strain that possesses semi-dense foliage and elliptical form.

Eastern red cedar is an native conifer of wide distribution and great genetic diversity. Its adaptability to a variety of soil and climatic conditions has made the tree especially attractive for screening, windbarrier and landscape purposes.

As result of Eastern red cedar's inherent genetic diversity for growth form, crown density, seedling vigor, and growth rate, it is very important that the released variety be uniform and stable for these characteristics. Thus, in 1989 production was approached by both the development of improved seed stock and by vegetative propagation. If a successful propagation method can be developed, a superior form could be identified and clonally duplicated for use as a commercially available windbreak tree.

In 1988 selections were made for the best ecotypes remaining within the project. Twelve females and five males were chosen and transplanted into a polycross nursery in order to promote random cross-pollination. In November of 1989 seed was collected, mixed, and broadcast into woody beds for harvest during the 1991 season. In the fall of 1991, the seed planted in the woody beds was separated according to female accession number the seed came from. At the time of harvest, seedlings will be used for the establishment of field plantings for final evaluation.

Although literature review indicates that the vegetative propagation of Eastern red cedar is difficult, several research teams have demonstrated improved success rates by varying the type and timing of cutting as well as through the use of non-traditional growth promoter treatments. In January, 1991 a second vegetative propagation study took place at the PMC. Lateral shoot cuttings were obtained from male and female trees, trimmed to approximately 6-inches, and subjected to the following growth promotion treatments:

Treatment 1: IBA (10,000 ppm) in 50% alcohol

Treatment 2: IAA (10,000 ppm) in 50% alcohol

Treatment 3: NAA (10,000 ppm) in 50% alcohol

Treatment 4: IBA (10,000 ppm) in 50% alcohol, 20% DMSO

Treatment 5: IBA (10,000 ppm) in 50% alcohol, 20% Dimethyl Formamide

Treatment 6: IAA (10,000 ppm) in 50% alcohol, 20% DMSO

Treatment 7: IAA (10,000 ppm) in 50% alcohol, 20% Dimethyl Formamide

Treatment 8: Rootone (2000 ppm NAA, 1000 ppm IBA, 40,400 ppm Thiram)

Treatment 9: Control (untreated) in 50% alcohol

Cuttings were then placed into a bottom-heated propagation bench in the PMC greenhouse. Mist-irrigation was used to prevent dessication.

Indoleacetic acid (IAA) is a naturally occurring auxin-type plant hormone. Indolebutyric acid (IBA) and alpha napthalene acetic acid (NAA) are synthetically produced growth promoters. Likewise, "Rootone" is a commercially available talc-based growth promoter containing NAA, IBA, and Thiram, a fungicide. Dimethyl formamide and dimethyl sulfoxide (DMSO) are aprotic solvents with extremely high dielectric constants and, thus, which have the potential to increase the transport and incorporation of growth promoters and hormones into the target plant tissues.

After approximately 246 days of being maintained in the propagation bench, all cuttings were exposed, rinsed, and examined for mortality, callus production, and root production, (See Table 1). The female accession out performed the male accession. Strong differences were noted for the percent mortality, percent callus production, and percent root production between the various growth promotion treatments. The IBA, IBA & DMSO, and Rootone were clearly superior to the other treatments. The worst treatment was NAA which produced no rooting or callusing in the cuttings.

Table 1

Percent of cuttings with callus production and root production, and percent mortality for the 1990-91 low-cost methodology for the vegetative propagation of Juniperus virginiana. 1/

Treatment	Average Mean Percent Mortality		Mean Percent Callusing		Mean Percent Rooting	
	Male	Female	Male	Female	Male	Female
IBA (10,000 ppm)	90	55	0	20	15	25
IAA (10,000 ppm)	95	70	0	45	0	5
NAA (10,000 ppm)	100	100	0	0	0	0
IBA (10,000 ppm) & DMSO (20%)	80	15	0	45	20	65
IBA (10,000 ppm) & dimethyl formamide (20%)	95	65	0	25	5	35
IAA (10,000 ppm) & DMSO (20%)	100	80	0	20	0	20
IAA (10,000 ppm) & dimethyl formamide (20%)	95	65	0	30	5	35
Rootone	100	35	0	25	0	65
Control	60	60	0	45	5	30

1/ Evaluation began on Dec. 3, 1990. Evaluation completed on Aug. 8, 1991. Two replications of twenty cuttings total (ten male - 9047099, ten female -9047095) were evaluated per treatment per replication.

1991

CONTRACTILE AGREEMENTS WITH THE NATIONAL PARK SERVICE

1. Annual Progress Report for Assateague Island National Seashore

2. Annual Progress Report for Gateway National Area

1991 Annual Progress Report for Assateague Island National Seashore

I. Project Background

The Cape May Plant Materials Center entered into a contractile agreement with the National Park Service to propagate native plant species for Assateague Island National Seashore. Currently, three grass species, three forb species, five shrub species, and three tree species will be provided to this National Seashore to protect roadways and re-vegetate old road scars in public use areas.

Since this contract was organized and approved in 1991, much of the PMC's activities have focused on seed collection. Germ plasma, from nine of the fourteen species requested in the contract, was collected on Assateague Island during 1991 in four separate trips. Three other species were collected in New Jersey, while one, red maple, was not collected in '91 due to lack of a good seed crop to collect from. All seed collected in 1991 was cleaned and processed within one to two weeks as long as the moisture level had been reduced to an acceptable level. Germination tests have been carried out on six species with two more scheduled for early 1992. Evaluations of any of the species listed in this contract will not begin until a large enough population has emerged.

The plants produced at the Cape May PMC will be planted at twelve different sites located in the publicly accessible areas. The plants will be placed in nine areas where old road beds are still visible, along a new road in a newly developed camping area, culdesac islands which lack vegetation, and area dunes bordering roads which need stabilization.

Since this contract is still only in its early stages, no significant new or innovative technology has been developed. Due to the variety of species being propagated, it will only be a short period of time before new knowledge is documented.

II. Accessions Involved:

Common Name	Scientific Name	Plant Symbol	Acc. No.
red maple	Acer rubrum	ACRU	-
American beachgrass	Ammophila breviligulata	AMBR	Cape
thoroughwort	Eupitorium sp.	EUsp.	9064220
beach heather	Hudsonia tomentosa	HUTO	9064219
eastern red cedar	Juniperus virginiana	JUVI	9064218
wax myrtle	Myrica cerifera	MYCE	9064217
bayberry	Myrica pensylvanica	MYPE2	9064216
coastal panicgrass	Panicum amarum	PAAM2	421136
switchgrass	Panicum virgatum	PAVI2	421138
loblolly pine	Pinus taeda	PITA	9064215
dwarf sumac	Rhus copallinum	RHCO	9064214
northern dewberry	Rubus flagellaris	RUFL	9064213
seaside goldenrod	Solidago sempervirens	SOSE	9064212
highbush blueberry	Vaccinium corymbosum	VACO	9064211

1991 Annual Progress Report for Gateway National Area

I. Project Background

The Cape May Plant Materials Center entered a contractile agreement with the National Park Service to propagate native plant species for the Jamaica Bay and Breezy Point Units of Gateway National Recreation area. There will be three grass, two forb, three shrub and four tree species provided to this recreation area to re-vegetate road scars and newly constructed public use areas.

Since 1991 was the first year of this contract, much of the PMC's activities have focused on seed collection. All germplasma collected so far has come from within the recreation area when possible, as requested by the National Park Service. Initial seed cleaning has taken place prior to fall and spring sowing. Germination tests are completed on some species as noted in Section IV. No evaluation will take place on the listed species until they have emerged.

The plants produced by the Cape May Plant Materials Center will find their way to two major road construction sites. The first is a visitor parking area near Fort Tilden. The second project receiving plants from Cape May is a new parking facility at the Jamaica Bay Wildlife Refuge Visitor Center.

No significant new technology has been found or developed as of this date. Some innovative cleaning and propagating techniques have been explored but it is still too early to determine if they are better than traditional methods.

II. Accessions Involved:

Common Name	Scientific Name	Plant Symbol	Acc. No.
wild indigo	Baptisia tinctoria	BATI	9064210
gray birch	Betula populifolia	BEPO	9064209
hackberry	Celtis occidentalist	CECO	9064208
partridge pea	Chamaecrista fasciculata	CHFA2	9064207
eastern red cedar	Juniperus virginiana	JUVI	9064206
spicebush	Lindera benzoin	LIBE3	9064205
tulip poplar	Liriodendron tulipifera	LITU	9064204
bayberry	Myrica pensylvanica	MYPE2	9064203
coastal panicgrass	Panicum amarum	PAAM2	421136
switchgrass	Panicum virgatum	PAVI2	9064202
beach plum	Prunus maritima	PRMA2	9064201
white oak	Quercus alba	QUAL	9064200
Virginia rose	Rosa virginiana	ROVI2	9064199
little bluestem	Schizachyrium scoparium	SCSC	9064198
seaside goldenrod	Solidago sempervirens	SOSE	9064197

1991

MISCELLANEOUS PMC PROJECTS

INITIAL EVALUATION OF VETIVER GRASS (*VETIVERIA ZIZANIODES*) FOR ADAPTABILITY TO THE MID-ATLANTIC SERVICE AREA

INITIAL EVALUATION OF VETIVER GRASS (VETIVERIA ZIZANIOIDES) FOR ADAPTABILITY TO THE MID-ATLANTIC SERVICE AREA

Vetiver grass (Vetiveria zizanioides) is an Asian species that is primarily used for vegetative contour hedges and by the perfume industry. It is a densely tufted bunchgrass with stout culms up to 2 meters (6 feet) in height and terminal flowers consisting of numerous narrow racemes oriented in whorls along a central axis. Vetiver grass has an extensive branching root system that is considered useful for the prevention of soil erosion. Vetiver had been reported to lack viable flowers, rhizomes, or stolons, instead being propagated soley by root division or vegetative slips. However, two ecotypes of the grass have recently been documented: (1) a northern flowering type and (2) a southern non-flowering type. The two ecotypes differ in physiochemical characteristics, essential oil yield, and drought tolerance. Vetiver is native to warmer climates, being best suited to temperatures ranging from 21.0 to 43.5ˆC. Prior to introduction to the mid-Atlantic region, the northern-most successful planting has been in Rome, Italy, roughly 42ˆN in latitude and Mediterranean in climate.

The Cape May PMC currently is examining four accessions of vetiver grass:

196257 - Imported by the USDA/ARS Southern Regional Plant Introduction Station in 1951. No other available information.

213903 - Imported by the USDA/ARS Southern Regional Plant Introduction Station. Originally collected near Allahabad, India.

271633 - Collection number 1027 by the USDA/ARS, as imported through the Southern Regional Plant Introduction Station. Original collection site was located 18 km. north of Karmola, India.

302300 - Collection number A-7016 from India, as presented to the USDA/ARS Southern Regional Plant Introduction Station by Oklahoma State University.

0

All accessions were sent to the Cape May PMC as two year-old stock from the National PMC in Beltsville, Maryland. On May 3, 1990, eighteen (18) plants from each accession were outplanted on the PMC.

The vetiver accessions were excepted to winter kill during the winter of 1990/91 as Cape May, New Jersey is considered too far north for the growth of the grass. By the spring of 1991, it was found that 50-88% of the accessions were showing regrowth. Its believed the mild winter of 1990-91 was the cause of this survival percentage. Although survival was high, the regrowth of the plants was poor. Growth was found on the leeward side of the plants and was sparse.

CAPE MAY PMC CROP FIELDS

Field No.	1991
1	Inter-Center Strain Trial Test; *Uniola paniculata*, Sea Oats Nursery *Cynodon dactylon*, 'Tufcote' Bermuda Grass, *Ammophila breviligulata*, American Beachgrass Nursery, *Panicum virgatum* Switchgrass Nursery
2	*Onobrychis viciafolia*, sainfoin; *Anthoxanthum odoratum*, sweet vernalgrass
3&4	*Panicum virgatum*, NJ-50 switchgrass
5&6	*Juniperus conferta*, 'Emerald Sea' shore juniper; *Myrica pensylvanica*, bayberry; *Prunus maritima*, beach-plum; *Lathyrus sylvestris*, 'Lathco' flatpea
7	*Elaeagnus umbellata*, autumn olive Various woody production species
8	Vacant/Summer & Winter Cover Crop
9	Initial Increase Field
10	*Secale cereale*, 'Syn-T'Cereal Rye Production
11	*Secale cereale*, Comparative Study, 'Syn'-T' vs. 'Aroostook'; Cold Tolerant Cover Crop Study; Herbaceous Wind Barrier Study; *Ammophila breviligulata* American Beachgrass Longevity Study
12	*Panicum amarum* var. *amarulum* 'Atlantic' Coastal Panicgrass Produciton.
13	*Lespedeza thunbergii*, 'VA-70' Shrub Lespedeza Production
14	*Lespedeza thunbergii*, 'VA-70' Shrub Lespedeza Production
15	*Spartina alterniflora*, Smooth Cordgrass Increase; *Ammophila breviligulata*, 'Bogue' American Beachgrass Increase
16	Natural - Wildlife Area
17	Permanent Grass Cover
18	*Robinia pseudoacacia*, Black Locust Holding Block

CAPE MAY PMC CROP FIELDS

Field No.	1991
19	*Rosa rugosa*, poly cross; *Ammophila breviligulata*, 'Hatteras' American beachgrass Increase; *Spartina patens*, saltmeadow cordgrass; *Brassica pekinensis*, Peking cabbage
20	Permanent Cover Crop
21	Vacant/Cereal Rye Winter Cover
22	Woody Tree and Shrub Holding Block
23	*Panicum amarum* var. *amarulum* 'Atlantic' Coastal Panicgrass Production
24&25	*Panicum amarum* var. *amarulum*, 'Atlantic' Coastal Panicgrass Production
26	Vacant/Summer & Winter Cover Crop
27	*Secale cereale*, 'Syn-T' Rye Production; Water Quality-Nutrient Reclamation Study
28&29	*Secale cereale*, 'Syn-T' Rye Production
30	*Lathyrus sylvestris*, 'Lathco' flatpea; *Tripsacum dactyloides*, IE of
31	*Ammophila breviligulata*, 1991 'Cape' American beachgrass Prod.
32	*Juniperus virginiana*, eastern red cedar; *Spartina patens*, 'Avalon' Production; *Carex kobomugi*, 'Sea Isle' Japanses Sedge Production
33	*Ammophila breviligulata*, '92 Cape' American Beachgrass Production
34	Vacant/Summer & Winter Cover Crop
35,36 37,38	Hay/Alfalfa & Fescue Cover
39	Vacant/Summer & Winter Cover Crop
40	*Myrica cerifera*, Wax Myrtle Holding Block; *Lonicera macckii*, 'Rem-Red' Amur Honeysuckle Seed Orchard.

PLANT DESCRIPTIONS
of Commercially Released Cultivars

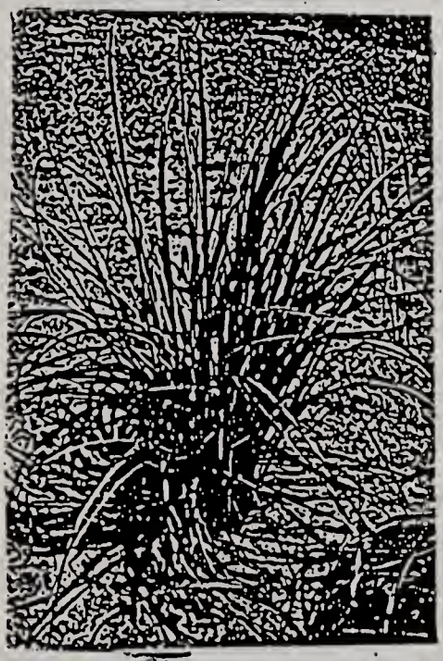


'Rem-Red' Amur Honeysuckle (Lonicera maackii)

'Rem-Red' is a multi-stemmed, vase-shaped shrub that grows to a height of 8 to 12 feet. The plant is well suited for ornamental use or as a screen on large lots. Its primary use is to supply a source of food for wildlife during the critical winter period.

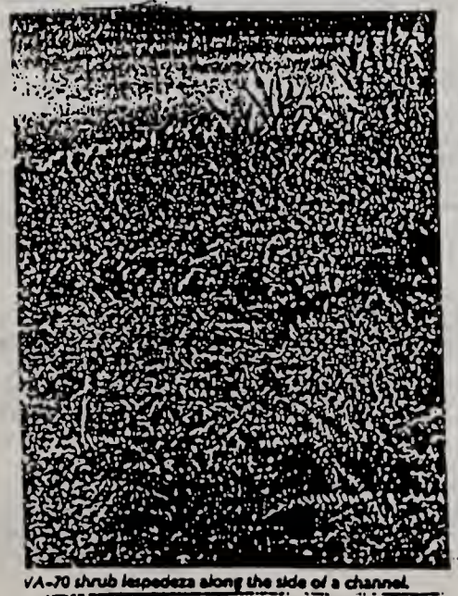
The plant's bright red fruit is about one-fourth inch in diameter and matures in late September and October. Amur honeysuckle grows best on deep, well-drained soil. The plant grows well in slightly acid soils with a sandy, loamy, or moderately clayey texture.

Rem-Red was released in 1970 as a multi-purpose plant. An adequate seed supply exists for commercial production.



'Cape' American beachgrass (Ammophila breviligulata)

'Cape' was released for commercial production in 1972. It is a superior strain of American beachgrass. It is used along the mid-Atlantic coast for initial stabilization and establishment of sand dunes. Cape is robust, easy to plant, and spreads rapidly by vigorous rhizomes. It has healthier leaves and thicker culms or ztems than common American beachgrass. An adequate supply of Cape beachgrass plants are available for commercial produotion.



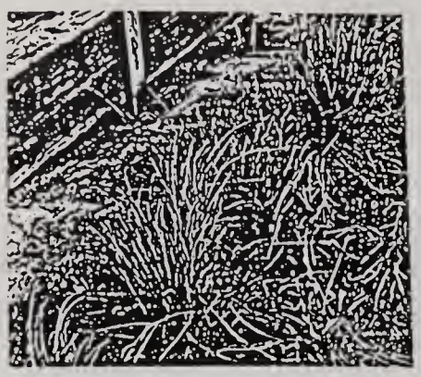
VA-70 shrub lespedeza along the side of a channel.

'VA-70' Shrub Lespedeza (Lespedeza thunbergii)

'VA-70' shrub lespedeza is a herbaceous legume with a semi-woody stem. It is an upright perennial with stems growing 4 to 6 feet tall. The leaves are more linear than oval and are approximately 2 inches long and one-half inch wide. Attractive pink to purple flowers appear in late summer. It is an excellent source of winter food and habitat for wildlife. Pheasants and bobwhite quail use its seed for food in fall and winter. Rabbit and deer browse the leaves and bees produce honey from the flowers.

You can use VA-70 shrub lespedeza almost anywhere that shrubs are appropriate. When used in hedges and borders, VA-70 is an attractive landscape feature. The plant is particularly well suited to seeding steep banks along channels and ditches or for wildlife borders along these water courses. It is useful as a border between cropland and woodland, as contour hedges between crop strips, along diversion terrace boundaries, and in small odd areas set aside for wildlife.

VA-70 shrub lespedeza can be used alone or with other plants. An adequate supply of seed is available for commercial production.



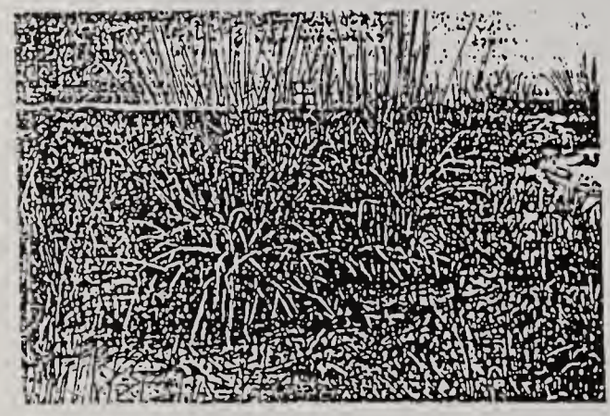
'Avalon' Saltmeadow Cordgrass (Spartina patens)

'Avalon' is a strongly rhizomatous, salt tolerant perennial grass that grows up to 2-1/2 feet tall. Its rhizomes are long and slender and produce most of the new growth.

Avalon is unique in that it spreads quickly and produces a more dense root system and finer roots than most other saltmeadow cordgrass strains.

The principal conservation use of Avalon is to vegetate and restabilize brackish and fresh water tidal streambanks. It is salt tolerant and can be established immediately above the mean high tide elevation. It is well adapted to a range of soils, will tolerate occasional inundation by storm tides, and has the ability to trap and grow through thin layers of sand. Avalon is also adapted to low elevation coastal sand dunes and can be used to supplement other sand dune vegetation.

For establishment, both potted and bare-root plants can be used. An adequate supply of bare-root plants is available for commercial production.



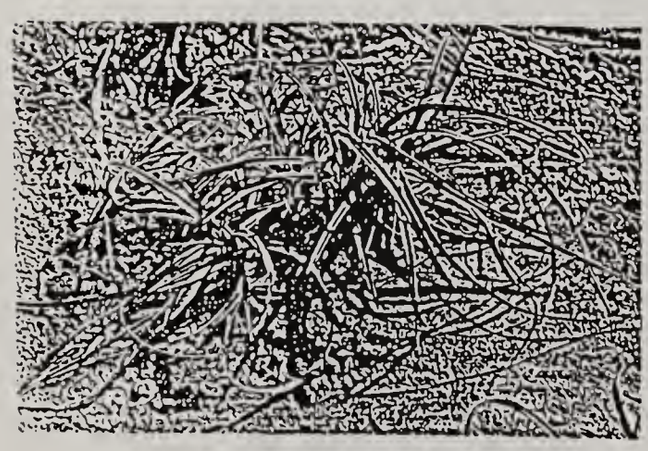
'Atlantic' Coastal Panicgrass (Panicum amarum var. amarulum)

'Atlantic' is a tall, robust, native warm season perennial grass. Its growth habit is upright, with stems reaching a height of 4 to 6 feet. The plants have the appearance of a bunch grass, although they produce short rhizomes. Atlantic has strong seedling vigor and reliable seed production under cultivation. It performs satisfactorily on sandy, droughty infertile soils and on heavy imperfectly drained soils.

The principal use of Atlantic is for stabilizing disturbed sandy sites. It can be direct seeded on sand dunes except for active frontal dunes. It has also been successfully established on surface mined areas, sanitary land fills, dredged spoil fills, sand and gravel mines, road side embankments and similar disturbed areas. While most stands of Atlantic are established by drilling the seed, small areas can be vegetated with seedling plants.

Field tests show Atlantic to be well adapted in the coastal plain and piedmont region from Massachusetts to Texas. It has also been grown inland in Pennsylvania and Ohio. Atlantic's resistance to lodging and its seed production also enhance its value as food and cover for wildlife.

It was cooperatively released by the Soil Conservation Service and the New Jersey Agricultural Experiment Station in 1981. Limited quantities of seed are available for commercial production.



'Sea Isle' Japanese Sedge (Carex kobomugi)

Japanese sedge has been introduced onto the dunes from New Jersey south to Virginia. It is native to northeastern Asia and exhibits several desirable characteristics for stabilizing sand dunes. Japanese sedge, a salt tolerant tufted plant, differs from most related sedges by growing in drier areas. The plant, which grows 8 to 10 inches tall, spreads primarily by short rhizomes which root at the nodes. Because of the short internodes, a mature stand of Japanese sedge is usually dense, with almost complete ground cover. This cool season plant remains green well into fall and can tolerate some, but not continuous, foot traffic.

'Sea Isle' tends to be long-lived on stable sand dunes. In addition, Japanese sedge appears to be tolerant of pests and low soil fertility. Consequently, Sea Isle may exist with less management. However, it will flourish under high levels of management such as routine fertilization and protection from pedestrian or vehicle traffic.

During the year of establishment, Japanese sedge has a higher mortality rate and exhibits little lateral spread when planted in spring. However, those established in the fall of the year prove to have good survival. Regardless, after the first year, stands of 'Sea Isle' continually improve in both vigor and density.

The plant was released in 1983 by the Soil Conservation Service and the New Jersey Agricultural Experiment Station. Limited quantities of plants are available for commercial production.



'Emerald Sea' Shore Juniper (Juniperus conferta)

'Emerald Sea' is a low-growing or trailing evergreen shrub which grows to approximately one foot in height. Its needles are greenish blue, softer than most junipers, and one-half to one inch long. The needles retain their blue-green color very well during the winter. Mass plantings produce a dense and uniform ground cover.

Shore juniper is well suited for planting on sand dunes near the seashore where other junipers do not grow successfully. It has good salt tolerance and grows well in sandy soils.

Emerald Sea is often used for mass or border plantings around buildings and as foreground for taller plant groups. It is also a versatile ground cover plant for steep banks around buildings, parks, and playgrounds.

An adequate supply of unrooted cuttings are available for commercial production.

SCS TRAINING RECEIVED

February 25-26	Plant Chemical Reclamation Study training at the University of Rhode Island was attended by Sandra Primard.
June 11-12	Plant Identification course taken by Michael Fournier and Sandra Primard at Rutgers University.
July 11	Computer software demonstration on nitrate leaching (NLEAP Program) at Washington, DC attended by Sandra Primard.
August 12-16	"Biology of Warm-Season Grasses" held in College Station, Texas attended by Mike Fournier and Sandra Primard.
September 12	Grammar & Usage Seminar held in Princeton, New Jersey was attended by Barbara Turnier.
October 29	"Effective Presentations" given by SCS-NJ in Somerset, New Jersey was attended by Michael Fournier.
November 4-8	"Farm Management and Agronomy Principles for PMC Biological Technicians held in Abilene, Texas was attended by Noel Murray and James Futrell.

PRESENTATIONS, PUBLICATIONS AND WORKSHOPS

January 31	Exhibit displayed by Don Hamer, Michael Fournier, Randy Mandel and Sandra Primard at the Gloucester County Farm Show.
May/June	Article written by Donald Hamer on "Better Plants for Conservation" in the Land and Water Journal: Vol. 35 pg. 12-13
July 10	Presentation by Sandra Primard at the American Society of Agronomy Northeast Regional Meeting at Rutgers University on "Evaluation of 13 Herbaceous Wind Barrier Species at Two Locations".
July 18	PMC Field Tour presented by Don Hamer, Michael Fournier, and Sandra Primard to the visiting Farmers Home Administration staff.
July 25	Training on Tidal Bank Stabilization by Don Hamer to staff of City of New York Parks and Recreation.
Sept. 21-22	Exhibit displayed by Donald Hamer, Michael Fournier, and Sandra Primard at the Wings and Water Festival held at the Wetlands Institute in Stone Harbor, New Jersey.
October 4	Workshop for sand dune stabilization by Don Hamer for the City of Cape May.
October 9	Presentation by Sandra Primard to the Acorn Garden Club of Upper Township, New Jersey on the PMC operations.
November 5	Workshop for sand dune stabilization by Donald Hamer for the City of Cape May.

BUILDINGS

September	A 21 x 60 ft. Polycarbonate Clearspan Greenhouse

EQUIPMENT

January	Bell Atlantic Telephone System
April	Kodak Projector
June	John Deere All-Materials-Transport Vehicle
June	AT&T Computer System
September	52-HP Case International Tractor
October	Olympus SZ Stereo Microscope
October	Four Ton Equipment Trailer